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MYCOLOGIA

VOL. X JANUARY, 1918 No. 1

PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—VII.[1] THE GENUS UNDERWOODIA

FRED J. SEAVER

(WITH PLATE 1)

The above genus was founded by Peck on three plants collected by J. T. Fischer at Kirkville, New York, July, 1889. As indicated by the author of the genus in connection with his original description, the three plants were split lengthwise and a half of each sent to him by Professor Underwood to whom the genus was dedicated. The other half of each plant was retained and eventually deposited in the herbarium of the New York Botanical Garden. A note by Underwood accompanying these specimens states, "The locality has been carefully searched every year from 1889 to 1895 with the above results." The results consisted of one specimen collected by Underwood in June, 1890, from which the accompanying photograph and drawings have been made; also fragments of a specimen collected by Underwood in June, 1893, making in all three collections of the species including the type.

On July 23, 1917, Mr. Stewart H. Burnham sent from Hudson Falls, New York, two small specimens of the species collected at Tripoli, New York, and determined by himself. This is the extent of our knowledge of the species so far as our own collections are concerned. While it is impossible to know how many

[1] An error occurred in the numbering of the last paper under this main title in MYCOLOGIA for March, 1917. It should have been numbered VI instead of V. The species illustrated was *Discina venosa*.

[MYCOLOGIA for November (9: 323–374) was issued November 15, 1917.]

times the species has been picked up, from the records and specimens seen it appears to be a very rare fungus and it is hoped that the publication of the illustration and description at this time may result in bringing to light other specimens which may have been collected in this or other states.

Peck in describing the plant states: "It is as if the stem of *Helvella crispa* should be deprived of its pileus and entirely covered with an adnate hymenium, thus becoming a stemless receptacle." Sections of the stem show it to be porous, the pores consisting of longitudinal cavities separated by partitions as indicated in the accompanying drawing.

Schroeter has placed this genus in the Rhizinaceae but as indicated by Underwood it belongs more properly with the Helvellaceae. While from its general form it would seem to be out of place among the cup-fungi, in a general way the Helvellaceae are included with this group in spite of their irregularity in form.

The genus appears to be well marked and stands as an excellent memorial to the man who has done so much to stimulate an interest in North American mycology.

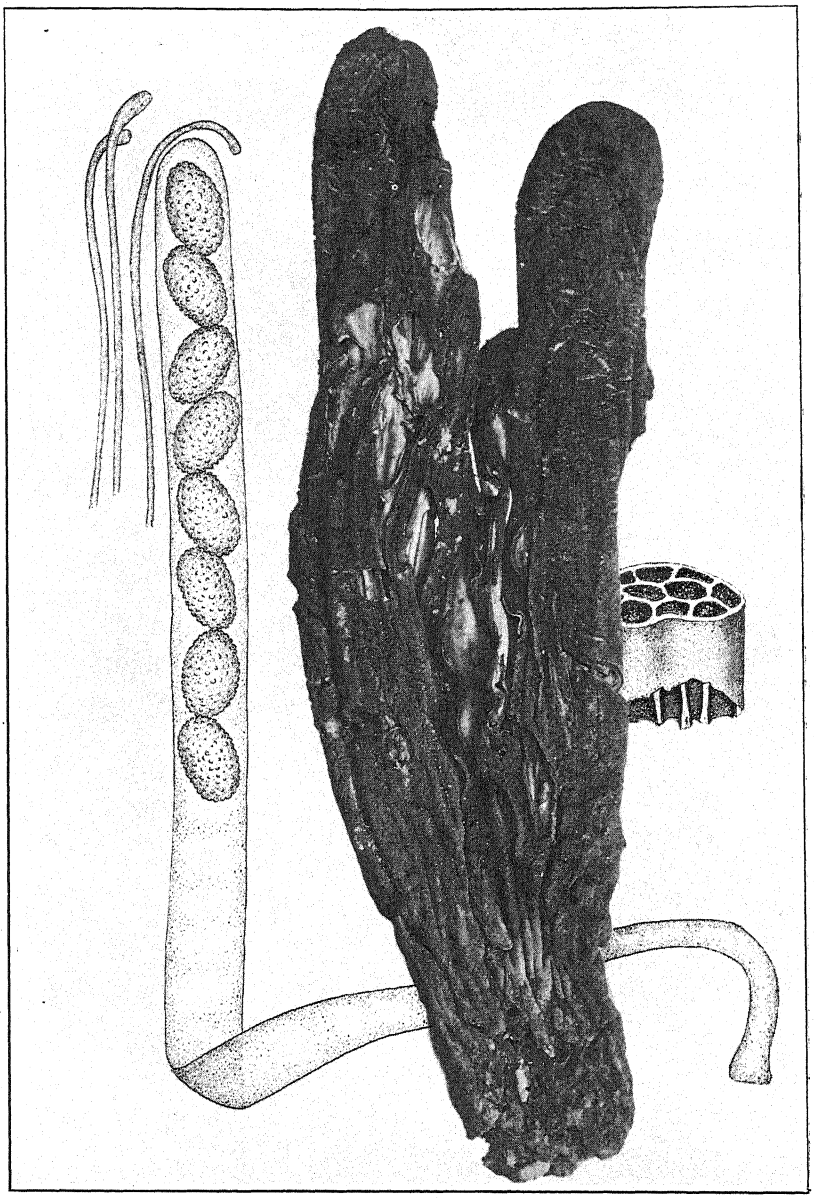
UNDERWOODIA Peck, Ann. Rep. N. Y. State Mus. **43**: 78. 1890

Pileus fleshy, more or less elongated or columnar, entirely covering the stem; hymenium covering the entire outer surface of the pileus, even or undulated; stem externally lacunose and internally containing several longitudinal cavities; asci cylindric above, 8-spored; paraphyses slender below, clavate above.

Type species, *Underwoodia columnaris* Peck.

UNDERWOODIA COLUMNARIS Peck, Ann. Rep. N. Y. State Mus. **43**: 78. 1890

Pileus clavate, columnar or slightly tapering above, straight or curved and often horn-shaped, entirely overspreading the stem; at first light-colored, becoming brownish; the entire fruiting body appearing like the stem of a *Helvella* entirely overspread with the pileus, reaching a height of 10 cm. and a diameter of 2–3 cm.; asci reaching a length of 350 μ and a diameter of 20 μ, tapering below into a stem-like base with a rather abrupt enlargement at the extreme base; spores 1-seriate or occasionally slightly



UNDERWOODIA COLUMNARIS PECK

crowded, ellipsoid, at first smooth, becoming sculptured, $12–14 \times 25–27\,\mu$; spore-sculpturing taking the form of rather coarse warts or small tubercles; paraphyses rather strongly thickened, brownish.

On soil among leaves.

TYPE LOCALITY: Kirkville, New York.

DISTRIBUTION: New York.

ILLUSTRATIONS: Ann. Rep. N. Y. State Mus. 43: *pl. 4, f. 1–4.*

NEW YORK BOTANICAL GARDEN.

NOTES ON THE ALTITUDINAL RANGE OF FOREST FUNGI

James R. Weir

The altitudinal range of forest tree fungi is a subject of some interest to foresters, and one seldom touched upon in forest pathological reports. During the seasons from 1912 to 1915 the writer, in connection with other work in the higher elevations of the Pacific Northwest, gathered considerable information on this subject.

Vegetation of Regions Visited

In most of the higher mountains in Washington, Oregon, Idaho, and Montana arctic conditions prevail during a part of the year. This is indicated by the occurrence of such heather-like plants as *Phyllodoce empetriformis* (Smith) Don, *Ledum glandulosum* Nutt., *Vaccinium microphyllum* Ryd., *Rhododendron albiflorum* Hook., *Gaultheria humifusa* (Graham) Ryd., *Cassiope mertensiana* (Bong.) Don, and by the alpine character of numerous herbaceous plants. On a few of the higher peaks arctic conditions exist for the entire year. The absence on many slopes of a suitable amount of soil capable of supporting any great amount of vegetation is probably more responsible for their alpine character than elevation and exposure. The regions visited do, however, represent the highest of the timbered plant zones for the Northwest.

The characteristic tree which lends the true alpine character to all high elevations in the Northwest is the alpine fir (*Abies lasiocarpa* (Hook.) Nutt.). It is usually associated with the mountain or black hemlock (*Tsuga mertensiana* (Bong.) Carr.) This hemlock is not, however, universally distributed as is the alpine fir but occurs sparingly in certain regions. A tree that reaches the highest elevations and is quite generally mixed with the alpine fir is the white bark pine (*Pinus albicaulis* Engelm.).

The limber pine (*Pinus flexilis* James) is also a timber line tree in several regions visited, as is also the alpine larch (*Larix lyallii* Parl.). Other trees reaching well up into the subalpine zone are lodgepole pine (*Pinus contorta* Loud.), Engelmann spruce (*Picea engelmanni* Engelm.), and Douglas fir (*Pseudotsuga taxifolia* (Lam.) Britton), the latter often assuming most peculiar and grotesque shapes.

Although most of the higher elevations visited represent the timber line for the region, the fungi collected would be found at a much greater elevation farther south, since the altitude of the timber line varies with the latitude in that direction while the reverse is true to the northward. Specimens of forest tree fungi at hand from some of the mountain ranges to the south and from northern Alaska show this to be true.

FACTORS GOVERNING THE ALTITUDINAL RANGE OF FOREST FUNGI

In the course of the collection of fungi on high mountains many points of interest have been recorded. Certain species disappear with increasing elevation, some are chiefly associated with particular forest zones, while others are more cosmopolitan and are found in greater or less quantity at all elevations. Some species always occur in greater or less quantity under all conditions provided their hosts are present. For example, *Fomes pini* (Brot.) Lloyd and *Echinodontium tinctorium* E. & E. are always found to accompany their respective hosts to the absolute timber line. Both species primarily belong to the lower forest zones. Tubeuf[1] reports the occurrence of *Fomes pini* on *Pinus cembra* in the Bavarian Highlands at an elevation of 1700 m. (5610 feet).

In ascending a high mountain it is soon noticed that the number of fungous species, likewise their abundance, decreases with increasing elevation. Barring the demands on moisture this seems to be due to the influence of temperature. It is known that there is a particular optimum temperature for spore germination about which many species seem to oscillate. This may vary from the temperature at which the best mycelial growth of the

[1] Tubeuf, C. v. Notizen über die Vertikalverbreitung der *Trametes pini* und ihr Vorkommen an Verschiedenen holzarten. Naturw. Zeitschr. f. Land- u. Forstw. 4: pp. 96–100.

same species occurs. Since in most cases new infections must originate from the spore, a species may be confined to that elevation and to those conditions of exposure where the most favorable temperature for spore germination exists for the greatest length of time. After becoming thoroughly established in the substratum the effect of this influence may not be so marked. A higher or lower temperature may then only serve to retard the activity of the mycelium and not endangered its existence. Some fungi, in fact, are truly alpine in habit and are not usually found growing below a certain elevation and will die if transferred to lower altitudes. This fact can be demonstrated experimentally as the following data will show.

By carefully transplanting (July 3, 1913) three seedlings each of alpine fir and white bark pine infected with *Herpotrichia nigra* Hartig and *Neopeckia coulteri* (Pk.) Sacc., respectively, from an elevation of 6735 feet (2052.8 m.) into lowland of 2500 feet (762 m.), the mycelia of these fungi after making an average growth of eight centimeters ceased altogether in August of the following year or thirteen months after the transfer. Both species died shortly afterward. The hosts continued to live. This result, though based on a single experiment, indicates that an average low temperature may be necessary for the development of these species.[2]

The coldest weather anywhere in the Northwest at any elevation is not sufficient to destroy the vitality of the sporophores of the common forest tree fungi. On the return of normal growing conditions, even though this period is short, all vital functions are resumed. The minimum temperature at which the sporophores of the common species are capable of withstanding is extremely low. Buller[3] has demonstrated "that the fruiting bodies of

[2] An interesting fact brought out by this experiment was that the spores of each species produced in perithecia developed while in the new habitat did not undergo any change in color, shape, dimension, number of septa, or arrangement in the ascus different from the usual type of spore which has always characterized these plants as two distinct species.

[3] Upon the retention of vitality by dried fruiting bodies of certain Hymenomycetes including an account of an experiment with liquid air. Trans. of the British Mycological Society. 1912. P. 112.

Also Buller and Cameron. On the temporary suspension of vitality in the

Schizophyllum commune, after having been kept dry and exposed to the air for two years and eight months, are able to retain their vitality when subsequently they have been dried *in vacuo* by the phosphorus pentoxide and charcoal-bulb liquid air method and subjected to the temperature of liquid air (— 190° C.) for three weeks." This shows the wonderful powers of resistance against drought and cold by this species. The same author demonstrated that a number of the sporophores of the common wood-destroying fungi have the ability to withstand very low temperatures. It is interesting to note in the list at the end of this article that the xerophilous species are well represented in high altitudes.

With regard to the form and general development of the aerial parts of the larger fungi in high mountains, there are many analogies with the higher plants. Some species have developed special structures in order the better to withstand the drying winds of high elevations. *Polyporus leucospongia* Cke. is a notable example of this. It has been observed that the spongy layer of the sporophore retains moisture for a considerable period following a rain. This aids in keeping the sporophore moist and furthers its development. Perennial polypores under alpine conditions are usually distinguished from the same species in the lowlands by their small size, different color, inclination to the resupinate form, and a hard context. The sporophores of *Fomes pini* at high elevations are small and either appear just under branches or in a poria-like form in the clefts of the bark. Fungi in well protected sites as compared to those in the arid wind-swept areas are larger and there is a greater variety and number of species. Up to an elevation of about 4000 feet (1219 m.) there is practically no difference in the position or location on their substrata of the wood-destroying fungi. Sporophores occur quite promiscuously on fallen trunks or high up on standing trees. At 4000 to 5000 feet elevation the sporophores of *Echinodontium tinctorium* and *Fomes pini* may occur as high up on their hosts as in the lowlands depending upon the height, size, and age of the trees. With increasing elevation the sporophores

fruit bodies of certain Hymenomycetes. Trans. of the Royal Soc. of Canada. Third series. **6**: pp. 73–75. 1912.

of these and other species growing on standing trees are usually found nearer the earth.

It is very evident that the occurrence of fungi, particularly the fleshy species, in elevated regions is closely correlated with the ratios of evaporation and precipitation. The excessive precipitation in the form of rain and snow is counteracted by the rapid evaporation from all substrata except in the more protected places or on north slopes. The influence of topography in this respect tends to produce a wide variation in the fungous flora in very narrow confines. Rounded peaks have many exposures. Consequently, fungous associations on the same mountain may be widely different. Though trees may be present on exposed windswept sites, all classes of fungi except a few perennials or species with special adaptation are usually absent. Those that do occur on such sites, if not found to be entirely different species from those occurring in protected exposures where the snow collects, are often so modified that they could well be classed as biological forms. Some of the fungi usually characterizing exposed sites are *Lentinus lepideus* Fr., *Lenzites sepiaria* (Wulf.) Fr., *Polystictus hirsutus* Fr., *Polyporus leucospongia* Cke., and certain Patellea species. The greater amount of snow on protected sites prevents the radiation of heat from the substrata, hence prevents evaporation and desiccation and usually promotes the development of certain fungi, particularly the more fleshy wood-destroying species. On the other hand, annual sporophores may be entirely absent under the more extreme conditions owing to the fact that snow shortens the period of vegetative growth or the weight and movement of snow is too great to be sustained.

Any factor that influences the cellular and chemical development of the wood of a tree may influence the growth of some wood-destroying fungi, hence their distribution. Aside from the moisture relation which is always a factor in promoting the growth of fungi, the influence of elevation on the chemical and anatomical structure of forest trees is a well known phenomenon and in a measure determines their predisposition to disease. According to Weber[4] the organic content of larches and beeches

[4] Einfluss des Standortes auf die Zusammensetzung der Asche von Lärchen. Allgem. Forst.- u. Jagdzeitung. P. 367. 1873.

regularly increases with increase in elevation with exactly the reverse for the mineral substances. With increasing elevation, certain anatomical changes in forest trees such as narrower rings imparting a hard flinty condition to the heartwood,[5] tend to reduce their disposition to disease. The influence of high mountain conditions on the prevalence of fungi is more noticeable in the case of leaf and twig diseases because of certain modifications of the host which makes attack by parasites difficult. The foliage of forest trees and other plants at high elevations is usually greatly modified to withstand arid conditions. This modification is generally expressed by a thicker epidermis, excessive development of hairs and waxy coverings and, no doubt, retards and in many cases absolutely prevents infection. Very few endophytic leaf parasites have been collected at high elevations. On the other hand, epiphytic species are more common. With the reverse of these conditions in the lowlands the same species may be and usually are more seriously attacked by fungi. The difficulty experienced in the cultivation of the larch in the lowlands of Germany owing to the increased destructiveness of *Dasyscypha Willkommii* Hartig is a case in point.

Any forest tree with a great altitudinal range is more severely attacked by fungi at its lowest elevation. As examples, grand fir (*Abies grandis* Lindl.), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and alpine fir, particularly show this to be true. The problems of management with regard to forest tree diseases in the highest elevations at which merchantable forests can be grown will never be as difficult as at lower levels. The fact that the tree species will be more or less separated into their component types will not at this elevation be as serious a factor in promoting the spread of fungous diseases as at lower elevations. The big problem at low elevations in reducing the ravages of fungi is to find the environment best suited for the several species

Einfluss des Standortes auf den Aschengehalt des Buchenlaubes. Allgem. Forst.- u. Jagdzeitung. P. 221. 1875.

Also Cieslar, A. Uber den Ligningehalt einiger Nadelhölzer. Mitt. a. d. Forst. Versuchswesen Osterreichs. v. 23: 1897.

[5] Rosenthal, M. Uber die Ausbildung der Jahresringe an der Grenze des Baumwuches in den Alpen. Cit. Bot. Centralbl. nr. 43. 1904. Sendtner, Vegetationswerk. Sudbayerns. P. 555.

at that elevation. Trees growing in an unfavorable environment are invariably more seriously diseased. To attempt the development of a pure larch forest on low undrained soil is to give it over to serious decay.

Until the time comes to practice silviculture in the higher elevations the search for the greatest altitudinal range for our common forest fungi is chiefly of mycological interest. Recent studies show that many of the species found at all elevations are of greatest economic importance at particular elevations and in particular forest zones as influenced by physical environment. It is entirely possible in restricted areas to group the forest fungi of greatest economic importance with regard to amount of damage done according to the different forest zones. For example, in northern Idaho, *Fomes pini, Polyporus schweinitzii, Fomes annosus, Echinodontium tinctorium, Armillaria mellea* are of far greater importance in point of damage done in the white pine zone than in any other. The problem then is to search out the factors which govern the prevalence and distribution of fungi in the several forest types and balance them in such a way as to produce the best possible results in tree growth.

FUNGI COLLECTED AT HIGH ELEVATIONS

The following is a list of fungi either collected or observed at high elevations in the principal mountain regions of the Northwest between 44° to 49° latitude and 109° to 124° longitude. From the fact that most of the common genera are represented, a special and detailed search at different seasons would, no doubt, reveal a far greater number of species than here recorded. The species here listed with the exception of those entirely confined to high elevations have not been found in abundance but occur only occasionally. Although numbered among them are many of of the most destructive species of lower forest zones, they have not been found to cause any great damage to forest growth at high elevations over large areas. It is proposed to add to this list as the explorations continue.

TABLE I.—*Showing the Highest Elevation at Which Some Common Forest Fungi have been Found, Giving Host, Mountain Range, and Peak where Observation was Made*

(Region between 44° and 49° latitude and 109° and 124° longitude)

Name of fungus	Host	Mountain range and peak	Elevation	
			Feet	Meters
Armillaria mellea (Vahl.) Quel.	Abies lasiocarpa	Selkirks; Mt. Casey	6735	2052
Calyptospora columnaris (A. & S.) Kuhn.	Vaccinium microphyllum	Selkirks; Smith Peak	5650	1722
Chlorosplenium aeruginosum Fr.	Fallen twigs	Selkirks; Mt. Casey	6735	2052
Corticium lividum Pers.	Picea engelmanni	" " "	6735	2052
Corticium laetum Karst.	Alnus tenuifolia	" " "	6735	2052
Corticium corruge Burt.	Abies lasiocarpa	St. Joe Mts.; Marble Mt.	6580	2005
Coleosporium solidaginis (Schw.) Thum.	Aster cusickii	Blue Mts.; Huckleberry Mt.	4911	1496
Coniophora arida Fr.	Picea engelmanni	Selkirks; Smith Peak	6000	1828
Cronartium comandrae Pk.	Comandra pallida	Bitter Root Mts.; Mt. Sentinel	5801	1768
Cytospora translucens Sacc.	Salix sp.	Selkirks; Smith Peak	7650	2331
Dacryomyces aurantia Schw.	Pseudotsuga taxifolia	" " "	4650	1417
Daedalea unicolor Bull.	Alnus tenuifolia	" " "	4650	1417
Daldinia concentrica Bolt.	Alnus tenuifolia	" " "	4650	1417
Diatrype bullata (Hoff.) Fr.		" " "	7650	2331
Echinodontium tinctorium E. & E.	Abies lasiocarpa	Cascades; Mt. Baker	7500	2286
Echinodontium tinctorium E. & E.	" "	Selkirks; Smith Peak	7450	2270
Echinodontium tinctorium E. & E.	Abies concolor	Blue Mts.; Huckleberry Mt.	5000	1524
Echinodontium tinctorium E. & E.	Abies grandis	Cabinet; Scotchman Peak	5250	1600
Exidia glandulosa Bull.	Salix sp.	Selkirks; Smith Peak	4200	1280
Exobasidium vaccinii (Fckl.) Wor.	Vaccinium membranaceum	Selkirks; Bald Mt.	4000	1219
Exobasidium vaccinii (Fckl.) Wor.	Vaccinium microphyllum	Selkirks; Smith Peak	7650	2331
Fomes annosus Fr.	Pinus albicaulis	" " "	7420	2260
Fomes igniarius Lin.	Alnus tenuifolia	" " "	7420	2260
Fomes officinalis Fr.	Pseudotsuga taxifolia	Selkirks; Mt. Casey	6735	2052
Fomes pini Brot.	Pinus albicaulis	" " "	6735	2052
" " "	" "	Cascades; Mt. Baker	7500	2286
" " "	Pinus contorta	Selkirks; Mt. Casey	6735	2052
" " "	Abies lasiocarpa	Continental Divide; Mudd Creek	7250	2209
Fomes pinicola Swartz	Pinus albicaulis	Selkirks; Mt. Casey	6735	2052
" " "	" "	Cascades; Mt. Baker	7600	2316
" " "	Pinus flexilis	Continental Divide; Mt. Haggin	8500	2590

TABLE I.—(*Continued.*)

Name of fungus	Host	Mountain range and peak	Elevation	
			Feet	Meters
Grandinia granulosa Pers.	Larix lyallii	Continental Divide; Mt. Haggin	8500	2590
Geaster hygrometricus Pers.	Well submerged in soil	Cascades; Mt. Baker	7000	2133
Herpotrichia nigra Hartig	Tsuga mertensiana	St. Joe Mts.; Marble Pk.	6580	2005
Herpotrichia nigra Hartig	Picea engelmanni	Continental Divide; Mt. Haggin	7500	2286
Herpotrichia nigra Hartig	Abies lasiocarpa	Bitter Root Mts.; Tiger Peak	6635	2022
Herpotrichia nigra Hartig	" "	Selkirks; Mt. Casey	6735	2052
Hirneola auricula-Judae Lim.	" "	Cascades; Mt. Baker	6500	1981
Hymenochaete tabacina Sow.	Alnus tenuifolia	Selkirks; Mt. Casey	6700	2042
Hymenochaete corrugata Lev.	" "	" " "	6700	2042
Irpex lacteus Fr.	" "	Selkirks; Bald Mt.	6228	1898
Lachnella sp.	Picea engelmanni	" " "	5228	1593
Lentinus lepideus Fr.	Abies lasiocarpa	Selkirks; Mt. Casey	6735	2052
Lenzites sepiaria Fr.	Pinus albicaulis	Cascades; Mt. Baker	7500	2286
Lophodermium pinastri Schrad.	Pinus monticola	St. Joe Mts.; Marble Mt.	5000	1524
Melampsora bigelowii Thum.	Salix sp.	Selkirks; Smith Peak	5600	1706
Microsphaera diffusa C. & P.	Ledum glandulosum	Cascades; Mt. Baker	5000	1524
Merulius aureus Fr.	Pinus contorta	Selkirks; Mt. Casey	6735	2052
Merulius neveus Fr.	Alnus tenuifolia	" " "	6735	2052
Neopeckia coulteri (Pk.) Sacc.	Pinus contorta	Continental Divide; Mt. Haggin	8000	2438
Neopeckia coulteri (Pk.) Sacc.	Pinus albicaulis	Cascades; Mt. Baker	7500	2286
Neopeckia coulteri (Pk.) Sacc.	Pinus flexilis	Continental Divide; Mt. Haggin	8000	2438
Patella sp.	On wind eroded wood	Cabinet; Scotchman Peak	7011	2136
Peniophora crassa Burt	Picea engelmanni	Selkirks; Smith Peak	6200	1834
Peniophora globifera E. & E.	" "	" " "	6200	1834
Peniophora carnosa Burt	Abies lasiocarpa	St. Joe Mts.; Monumentals	6500	1981
Peridermium coloradense (Diet.) Arth. & Kern.	Picea engelmanni	Selkirks; Bald Mt.	5100	1554
Peridermium balsameum Pk.	Abies lasiocarpa	Cascades; Mt. Baker	6000	1828
Phlebia cinnabarina Schw.	Alnus tenuifolia	Cabinet; Scotchman Peak	7000	2133
Phragmidium occidentale Arth.	Rubus nutkana	Selkirks; Mt. Casey	6300	1920
Phragmidium Rosae-acicularis Liro	Rosa sayi	" " "	5000	1524

TABLE I.—(*Continued.*)

Name of fungus	Host	Mountain range and peak	Elevation	
			Feet	Meters
Phyllactinia corylea (Pers.) Karst.	Alnus tenuifolia	Bitter Root Mts.; Grizzly Peak	5977	1821
Polyporus amorphus Fr.	Picea engelmanni	Selkirks; Mt. Casey	6000	1828
Polyporus alboluteus Ellis	Larix lyallii	Bitter Root Mts.; Shattuck Mt.	7580	2310
Polyporus benzoinus Fr.	Tsuga mertensiana	St. Joe Mts.; Monumentals	6900	2103
Polyporus lucidus Leysser	" "	St. Joe Mts.; Marble Mt.	6000	1828
Polyporus picipes Fr.	Alnus sp.	Cascades; Mt. Baker	7000	2133
Polyporus leucospongia Cke.	Pinus contorta	St. Joe Mts.; Monumentals	6979	2127
Polyporus perennis L.	Ground	Continental Divide; Mt. Haggin	8500	2590
Polyporus tomentosus Fr.	"	Blue Mts.; Rock Creek Butte	8000	2438
Polyporus schweinitzii Fr.	Pseudotsuga taxifolia	Selkirks; Mt. Casey	6735	2052
Polyporus schweinitzii Fr.	Pinus albicaulis	Continental Divide; Sullivan Peak	8150	2484
Polystictus abietinus Dicks.	" "	Continental Divide; Mt. Haggin	8500	2590
Polystictus hirsutus Fr.	Alnus tenuifolia	Selkirks; Smith Peak	7650	2331
Polystictus versicolor L.	Pinus albicaulis	Selkirks; Smith Peak	7650	2331
" " "	Abies lasiocarpa	Cascades; Mt. Baker	7600	2316
Poria attenuata Pk.	Tsuga mertensiana	St. Joe Mts.; Marble Mt.	6580	2005
Puccinia calthae Lk.	Caltha biflora	Cascades; Mt. Baker	8000	2438
Pucciniastrum myrtelli (Schum.) Arth.	Vaccinium microphyllum	Blue Mts.; Huckleberry Mt.	4911	1496
Pucciniastrum pustulatum (Pers.) Diet.	Epilobium alpinum	St. Joe Mts.; Monumentals	4979	1517
Rhytisma arbuti Phill.	Menziesia sp.	Cascades; Mt. Baker	7600	2316
Scleroderma cepa	Embedded in earth	St. Joe Mts.; Monumentals	6979	2127
Solenia sp.	Betula glandulosa	Selkirks; Smith Peak	7000	2133
Stereum ambiguum	Abies lasiocarpa	" " "	7650	2331
Stereum fasciatum	Alnus tenuifolia	" " "	7650	2331
Stereum sanguinolentum A. & S.	Tsuga mertensiana	St. Joe Mts.; Marble Mt.	6580	2005
Stereum sulcatum Burt	Picea engelmanni	Selkirks; Smith Peak	6325	1927
Trametes carnea Nees	Pinus contorta	Selkirks; Mt. Casey	6735	2052
Trametes heteromorpha	Abies lasiocarpa	Continental Divide; Mt. Haggin	8000	2438
Trametes serialis Fr.	Pinus contorta	Continental Divide; Mt. Haggin	9988	3044
Trametes setosus Weir	" "	Continental Divide; Mt. Haggin	8000	2438
Uredinopsis Pteridis Diet. & Holw.	Pteridium aquilinum pubescens	Selkirks; Mt. Casey	5735	1748
Uredo holwayi Arth.	Tsuga mertensiana	St. Joe Mts.; Monumentals	4900	1493
Uropyxis sanguinea Pk. & Arth.	Berberis aquifolium	Selkirks; Mt. Casey	5735	1748

SUMMARY

Most forest fungi have a great altitudinal range, being found from sea level to the extreme limits of the timbered zones.

Most of the common forest fungi are found at the highest timbered zones but are not so abundant as at lower elevations.

Certain of the more economic species predominate in particular forest zones or types.

Some species are strictly alpine in habit and are not found below certain elevations and exhibit particular adaptation to their environment.

With increasing elevation the sporophores of certain fungi predominating in lower forest zones exhibit many changes in form, structure, and in mode and place of attachment. The great variation in the temperature and moisture relation induced by the diversity of high mountain regions may greatly influence the development of the aerial parts of wood-destroying fungi but may not materially influence their development within the substratum.

The influence of high mountain conditions on the form and structure of host plants in turn influence the growth of their fungous parasites.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
MISSOULA, MONTANA.

THE AGARICACEAE OF TROPICAL NORTH AMERICA—VII

William A. Murrill

The last article of this series, concluding a partial treatment of the rusty-spored species, appeared in *Mycologia* for January, 1913. Since that time, the entire group of Pholiotanae has been taken up in *North American Flora*, volume 10, part 3, for the temperate as well as the tropical regions of North America. and the various rusty-spored genera have been treated in their proper order as far as *Inocybe,* which genus will, with *Pholiota, Cortinarius,* and *Locellina,* be considered in forthcoming parts of that work.

The next and last subtribe of the Agariceae is now to be considered, at least so far as our tropical species are concerned. The following key includes all the genera in this subtribe, some of which are not represented in tropical America, but another article will be required to complete the treatment of the species.

Subtribe 4. AGARICANAE

Hymenophore dimidiate, sessile or with short, lateral stipe.	1. Melanotus.
Hymenophore circular, with central stipe.	
Volva absent.	
Lamellae not deliquescent.	
Stipe slender, tubular, with a cartilaginous cortex; annulus absent except rarely in *Campanularius*.	
Lamellae decurrent.	2. Deconica.
Lamellae adnate or adnexed.	
Margin of pileus at first straight and appressed to the stipe.	
Spores purplish-brown or dark-fuscous.	3. Atylospora.
Spores black.	4. Psathyrella.
Margin of pileus at first incurved.	
Spores purplish-brown or dark-fuscous.	5. Psilocybe.

Spores black.	6. CAMPANULARIUS.
Stipe fleshy or fibrous, of uniform texture.	
Veil absent, inconspicuous, or appendiculate, not forming an annulus.	
Lamellae adnate or adnexed.	
Hymenophore solitary or subcespitose, rarely densely cespitose; hygrophanous, viscid, or squamulose.	7. DROSOPHILA.
Hymenophore densely cespitose; surface firm, dry, glabrous.	8. HYPHOLOMA.
Lamellae free.	9. PILOSACE.
Veil conspicuous, forming an annulus.	
Lamellae decurrent, waxy; veil glutinous; spores black.	10. GOMPHIDIUS.
Lamellae not as above.	
Lamellae adnate or adnexed.	11. STROPHARIA.
Lamellae free.	12. AGARICUS.
Lamellae deliquescent, melting to an inky fluid.	13. COPRINUS.
Volva present.	14. CLARKEINDA.

1. MELANOTUS Pat. Tax. Hymén. 175. 1900

According to Patouillard, this genus corresponds to *Crepidotus*, of the rusty-spored series, but differs in having spores that are purplish-brown, with an apical pore.

Pileus about 1 cm. broad.	1. *M. musicola.*
Pileus 2–3 cm. broad.	2. *M. fumosifolius.*

1. **Melanotus musicola** (Berk. & Curt.)

Crepidotus musicola Sacc. Syll. Fung. **5**: 883. 1887.

Described from Wright's collections on dead plantain leaves in Cuba. Specimens from Guadeloupe and St. Vincent determined as *Crepidotus alveolus* at Kew may belong here or with *Melanotus fumosifolius.*

2. **Melanotus fumosifolius** (Murrill)

Crepidotus fumosifolius Murrill. N. Am. Flora **10**: 156. 1917.

Described from specimens collected by Earle on a dead log at Rose Hill, Jamaica. It is common also on dead banana leaves. The spores are broadly ovoid, smooth, decidedly purplish-brown, $5–7 \times 3.5–5\ \mu$.

Santiago de las Vegas, Cuba, *Earle 32, 48*; Utuado, Porto Rico, *Mrs. Britton & Miss Marble 1210*; Castleton Gardens, Jamaica, *Murrill 131*; Mooretown, Jamaica, *Murrill 137, 157*; Sir John Peak, Jamaica, *Murrill 798*; British Honduras, *Peck*; Jalapa, Mexico, *Murrill 97*; Orizaba, Mexico, *Murrill 850*; Motzorongo, Mexico, *Murrill 1060*; Xuchiles, Mexico, *Murrill 1129*.

2. DECONICA (W. G. Sm.) Sacc. Syll. Fung. **5**: 1058. 1887

This is a very small genus, separated from *Psilocybe* as a subgenus by W. G. Smith in 1870, because of its decurrent lamellae, and raised to generic rank by Saccardo in 1887. There are only two tropical North American species, both occurring on manure.

Pileus 2 cm. broad; spores 12 μ long. 1. *D. bullacea.*
Pileus 0.5 cm. broad; spores 7 μ long. 2. *D. scatigena.*

1. DECONICA BULLACEA (Bull.) Sacc. Syll. Fung. **5**: 1058. 1887

Agaricus bullaceus Bull. Herb. Fr. *pl. 566, f. 2*; hyponym. 1791; Pers. Syn. Fung. 412. 1801.

This species was first figured by Bulliard from specimens collected in France. While probably widely distributed, it has not often been reported from this country. The spores of excellent specimens collected in Jamaica are ovoid, smooth, opaque, umbrinous by transmitted light under the microscope, 11–12 × 6–8 μ. Authentic specimens from Bresadola agree in every particular. The following collections were all made on horse manure in pastures and roads.

Jalapa, Mexico, *W. A. & Edna L. Murrill 29*; Cordoba, Mexico, *W. A. & Edna L. Murrill 887*; Santiago de las Vegas, Cuba, *Earle 62, 84*; Halls Delight, Jamaica, *Earle 117*; Cinchona, Jamaica, *W. A. & Edna L. Murrill 508, 531*; Grenada, *Broadway*.

2. DECONICA SCATIGENA (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1058. 1887

Agaricus scatigenus Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.

Known only from Wright's collections in Cuba. The species, which has the same habitat as the previous one, may be distinguished by its smaller size and smaller spores, the latter being only $7 \times 4 \mu$. It is just possible that this species is only a small, immature form of *D. bullacea*, but there is little chance of proving it. I have examined the spores of the type specimens and find them as represented.

3. ATYLOSPORA Fayod, Ann. Sci. Nat. VII. 9: 376. 1889

Psathyra Quél. Champ. Jura Vosg. 118. 1872. Not *Psathyra* Spreng. 1818. Not *Psathura* Commers. 1789.

Pluteopsis Fayod, Ann. Sci. Nat. VII. 9: 377. 1889.

This rather difficult genus, well represented both in temperate and tropical regions, is characterized by a cartilaginous stipe, a straight margin appressed when young, and the absence of a veil. It is difficult to distinguish in the herbarium from *Psilocybe* and *Drosophila*. *Psathyrella* differs in having black spores, but even here it is at times hard to draw the line.

Pileus white with blackish squamules, becoming smooth and purplish-brown with age.	1. *A. tigrina.*
Pileus not as above.	
Pileus 3–10 mm. broad.	
Stipe 5 mm. long; pileus avellaneous.	2. *A. diminutiva.*
Stipe 1–2 cm. long.	
Pileus whitish.	3. *A. commiscibilis.*
Pileus yellow.	4. *A. epibates.*
Pileus red.	5. *A. lateritia.*
Pileus pinkish-gray.	6. *A. byssina.*
Pileus pale-umbrinous.	7. *A. euthugramma.*
Pileus 1–2 cm. broad.	
Pileus white when moist, fulvous or umbrinous when dry.	
Stipe about 1 cm. long.	8. *A. coprinoceps.*
Stipe reaching 4 cm. long.	9. *A. Musae.*
Pileus uniformly avellaneous-isabelline.	10. *A. mexicana.*
Pileus pale-avellaneous, isabelline on the disk.	11. *A. albipes.*
Pileus sordid-luteous.	12. *A. bulbillosa.*
Pileus pale-fulvous with a peculiar sheen.	13. *A. pallidispora.*
Pileus bay, chestnut, or brown.	
Pileus not umbonate, slightly depressed.	14. *A. cubensis.*
Pileus umbonate.	
Surface decorated with white scales.	15. *A. plumigera.*
Surface glabrous.	

Surface not striate; stipe 1.5 cm. long.	16. *A. mammillata.*
Surface distinctly striate; stipe 3 cm. long.	17. *A. cinchonensis.*
Pileus 2–3 cm. broad.	
Pileus pallid with purplish tints.	18. *A. Roystoniae.*
Pileus avellaneous-isabelline.	19. *A. plana.*
Pileus fulvous.	20. *A. pseudotenera.*
Pileus fuliginous.	21. *A. fuliginosa.*

1. **Atylospora tigrina** (Pat.)

Psathyra tigrina Pat. Bull. Soc. Myc. Fr. **15**: 197. 1899.

Known only from specimens collected by Duss on rotten stumps at Basse-Terre, Guadeloupe. It has many characters in common with *Coprinus,* but the spores are purplish-brown.

2. **Atylospora diminutiva** sp. nov.

Pileus hemispheric to broadly convex, with a small umbo, not expanding, scattered, 6 mm. broad and 2 mm. thick; surface striate, uniformly avellaneous, glabrous; margin straight, entire, concolorous; lamellae adnate, ventricose, distant, umbrinous to fuliginous, paler and entire on the edges; spores broadly lemon-shaped, smooth, subopaque, uniguttulate, purplish-brown under the microscope, about $5 \times 4\,\mu$; stipe curved, equal, slightly roughened, umbrinous, 5 mm. long, 0.5 mm. thick.

Type collected on a dead fallen stick at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 463* (herb. N. Y. Bot. Gard.).

3. **Atylospora commiscibilis** (Berk.)

Agaricus commiscibilis Berk. in Warming, Vidensk. Meddel. **1879–80**: 33. 1879.

Psathyra commiscibilis (Berk.) Sacc. Syll. Fung. **5**: 1068. 1887.

Described from specimens collected at Rio de Janeiro. Brazil, by Glaziou, and also found in St. Thomas. The species greatly resembles *Psathyrella minutula* in general appearance, but is distinguished by its spores, which are ovoid to ellipsoid, smooth, purplish-brown under the microscope, $7–8 \times 4–5\,\mu$.

4. **Atylospora epibates** (Fries)

Agaricus epibates Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 26. 1851.

Psathyra epibates (Fries) Sacc. Syll. Fung. **5**: 1070. 1887.

Known only from specimens collected by Oersted on decayed wood in Naranjo, Costa Rica. This is a minute species resembling *Prunulus*, the slender stipe being orbicular at the base and appressed to the matrix. There is a good colored figure at Copenhagen, but no specimens have been found.

5. **Atylospora lateritia** sp. nov.

Pileus hemispheric to broadly convex, not expanding, solitary, 8 mm. broad, 3 mm. thick; surface smooth, glabrous, striate, dull-latericious, pale-testaceous on the disk; margin straight, entire, whitish; lamellae adnexed, rather broad, distant, pale-chestnut, entire and somewhat paler on the edges; spores ovoid or ellipsoid, smooth, usually 2-guttulate, purplish-brown, about $9 \times 5\,\mu$; stipe equal or slightly tapering upward, concolorous below, paler above, smooth, glabrous, 2 cm. long, 1–1.5 mm. thick.

Type collected among moss on a clay bank at Cinchona, Jamaica, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 471* (herb. N. Y. Bot. Gard.)

6. **Atylospora byssina** sp. nov.

Pileus strongly convex to plane, thin, fragile, not umbonate, gregarious, 5–10 mm. broad; surface varying from pinkish-gray to brown tinged with pink, glabrous, nearly smooth; margin entire, concolorous; lamellae adnate, crowded, rather broad, becoming dark-purplish-brown or almost black; spores ellipsoid, rounded at both ends, smooth, very pale purplish-brown under the microscope, $7\text{–}8 \times 4\text{–}5\,\mu$; stipe filiform, pallid or rosy-isabelline, smooth, glabrous, about 1.5 cm. long, less than 1 mm. thick, attached to the substratum by a very conspicuous, radiating mass of tomentum, which is evidently white when fresh, but slightly yellowish in dried specimens.

Type collected on a dead log in open woods at Rio Piedras, Porto Rico, December 1, 1915, *Bruce Fink 481* (herb. N. Y. Bot. Gard.). Also collected in the same locality on dead logs in

April and June, 1912, *J. R. Johnston 330, 420.* This species resembles *A. mexicana* and also species of *Coprinus*. Many of the pilei have deliquesced or otherwise disappeared, leaving only the stipes and the cottony patches of mycelium.

7. **Atylospora euthugramma** (Berk. & Curt.)

Agaricus euthugrammus Berk. & Curt. Jour. Linn. Soc. **10**: 290. 1868.

Naucoria euthugramma Sacc. Syll. Fung. **5**: 835. 1887.

Known only from minute specimens collected on decayed wood in Cuba by Wright. It is said by the author to have the habit of *Agaricus disseminatus* but to have spores quite different in color and size. I find them to be broadly ellipsoid, smooth, pale-purplish-brown under the microscope, $5 \times 4\,\mu$.

8. **Atylospora coprinoceps** (Berk. & Curt.)

Agaricus coprinoceps Berk. & Curt. Jour. Linn. Soc. **10**: 290. 1868.

Naucoria coprinoceps (Berk & Curt.) Sacc. Syll. Fung. **5**: 835. 1887.

Known only from specimens collected by Wright on logs in Cuba. The spores are too dark for *Naucoria*.

9. **Atylospora Musae** (Earle)

Gymnochilus Musae Earle, Inf. An. Estac. Centr. Agron. Cuba **1**: 239. 1906.

This species occurs on fallen dead stems and leaves of banana trees in Cuba, where it was found and described by Earle. Although very near to species of *Drosophila*, it seems to me to belong rather in *Atylospora*. The stipe is very slender, only 2 mm. thick, and the spores are ellipsoid or ovoid, smooth, 2-guttulate, nearly opaque, decidedly purplish-brown under the microscope, $6–8 \times 4–5\,\mu$.

10. **Atylospora mexicana** Murrill, sp. nov.

Pileus convex, not umbonate, not fully expanding, gregarious to subcespitose, 1 cm. broad; surface glabrous, smooth, some-

times pitted or reticulate-rugose in dried specimens, uniformly avellaneous-isabelline; margin paler, thin, entire, not incurved, but deflexed and appressed when young; lamellae adnate, arcuate, broad, rather crowded, white to pale-avellaneous and finally purpplish-brown with white edges; spores ellipsoid, rounded at both ends, smooth, pale-purplish-brown with a yellowish tint under the microscope, 7×3.5–$4.5\,\mu$; stipe curved, tapering upward, white, smooth and glabrous above, with abundant cottony tomentum at and near the base, 1.5 cm. long, 2 mm. thick.

Type collected on dead wood in a moist, virgin forest at Motzorongo, near Cordoba, Mexico, January 15, 1910, *W. A. & Edna L. Murrill 1073* (herb. N. Y. Bot. Gard.).

11. **Atylospora albipes** sp. nov.

Pileus convex, not umbonate, scattered, 1 cm. broad; surface striate, finely asperulate, pale-avellaneous, isabelline on the disk; margin straight, entire, concolorous; lamellae adnate, rather broad, crowded, white to pinkish, at length discolored; spores ellipsoid, smooth, decidedly purplish-brown under the microscope, about 7–8×4–$5\,\mu$; stipe very slender, subcartilaginous, equal, white, shining, hollow, 2–3 cm. long, 1–2 mm. thick.

Type collected on a decayed banana stalk in a ravine east of Hope Gardens, Jamaica, 240 m. elevation, December 12, 1908, *W. A. & Edna L. Murrill 22* (herb. N. Y. Bot. Gard.).

12. **Atylospora bulbillosa** (Fries)

Agaricus bulbillosus Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 26. 1851.

Psathyra bulbillosa (Fries) Sacc. Syll. Fung. **5**: 1065. 1887.

Known only from specimens collected by Oersted on the ground near Cartago, Costa Rica. The name refers to the enlarged, bulbous base of the stipe. There is a good colored figure at Copenhagen, but no specimens have been found.

13. **Atylospora pallidispora** sp. nov.

Pileus convex to subexpanded, with a short, cuspidate umbo, scattered, 1 cm. broad; surface finely tomentose, not striate, pale-fulvous with a peculiar sheen; lamellae adnate, rather crowded, broad behind, latericeous-fulvous, entire and pallid on the edges;

spores broadly ellipsoid or ovoid, smooth, very pale-purplish-brown with a yellowish tint under the microscope, 5–6 × 3.5–4 µ; stipe cylindric, equal, cartilaginous, concolorous above, darker below, finely fibrillose-lacerate, 1.3 cm. long, 1 mm. thick.

Type collected on a dead fallen stick at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 666* (herb. N. Y. Bot. Gard.).

14. **Atylospora cubensis** sp. nov.

Pileus thin, delicate, convex to expanded and slightly depressed, 1–1.5 cm. broad; surface glabrous, hygrophanous, pale-chestnut, paler when dry; margin faintly striate, concolorous; lamellae adnexed, crowded, subventricose, pallid to purplish-brown, entire and concolorous on the edges; spores ellipsoid, smooth, pale-purplish-brown under the microscope, 7 × 4–5 µ; stipe cylindric, white, shining, glabrous, hollow, 3 cm. long, 1–2 mm. thick.

Type collected by Mrs. C. F. Baker along paths at Santiago de las Vegas, Cuba, July 31, 1904, *F. S. Earle 138* (herb. N. Y. Bot. Gard.).

15. **Atylospora plumigera** (Berk. & Curt.)

Agaricus plumiger Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.
Psathyra plumigera (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1069. 1887.

Known only from Wright's collections on dead sticks in woods in Cuba. The spores are distinctly ovoid, smooth, pale-purplish-brown, about 8 × 5 µ.

16. **Atylospora mammillata** sp. nov.

Pileus conic to campanulate with a very prominent, conic umbo, not expanding, solitary, 1 cm. broad and 5 mm. high; surface glabrous, hygrophanous, not striate, fulvous-badious, fulvous on the umbo; margin dentate, spreading, paler; lamellae adnexed, ascending, narrow behind and very broad and ventricose in front, subcrowded, umbrinous, concolorous and entire on the edges; spores pyriform or strongly ovoid, tapering at one end, sometimes almost turbinate, smooth, clear-purplish-melleous under the microscope, 5–7 × 4–5 µ; stipe cylindric, equal, short, concolorous, whitish-pulverulent at the apex, 1.5 cm. long, 2 mm. thick.

Type collected in soil on a dry bank at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 608* (herb. N. Y. Bot. Gard.).

17. **Atylospora cinchonensis** sp. nov.

Pileus conic to campanulate, not expanding, rather thin, fleshy, with a prominent, conic umbo, 1.5 cm. broad and high; surface distinctly striate to the umbo, subglabrous, hygrophanous, umbrinous to fuliginous, fulvous on the umbo; margin straight, entire, concolorous; lamellae broad, ventricose, distant, fuliginous, concolorous and entire on the edges; spores broadly and distinctly ovoid, smooth, pale-purplish-brown under the microscope, about 5×3.5–$4\,\mu$; stipe curved, equal, smooth, glabrous, fulvous, pallid near the base, 3 cm. long, 1–2 mm. thick.

Type collected among moss in clay soil on a shaded bank at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 575* (herb. N. Y. Bot. Gard.).

18. **Atylospora Roystoniae** (Earle)

Gymnochilus Roystoniae Earle, Inf. An. Estac. Centr. Agron. Cuba 1:239. 1906.

Described from specimens collected by Earle on decaying logs of the royal palm near Managua, Cuba. Specimens collected by the writer in southern Mexico greatly resemble the types of this species and may not be distinct.

19. **Atylospora plana** sp. nov.

Pileus thin, delicate, expanded, almost perfectly plane, solitary, 2 cm. broad; surface striate, glabrous, avellaneous-isabelline, becoming isabelline when dry; margin concolorous, subentire, upturned on drying; lamellae adnate, narrow, crowded, becoming purplish-brown, whitish on the edges; spores ellipsoid, rounded at both ends, smooth, pale-purplish-brown with a yellowish tint under the microscope, indistinctly 2-guttulate, $7 \times 3.5\,\mu$; stipe slender, equal, smooth, glabrous, snow-white, yellowish in dried specimens, 3 cm. long, 2 mm. thick.

Type collected on dead wood at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 624* (herb. N. Y. Bot. Gard.). This species is near the boundary line between *Atylospora* and *Drosophila*.

20. **Atylospora pseudotenera** (Fries)

Agaricus pseudotener Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 26. 1851.

Psathyra pseudotenera (Fries) Sacc. Syll. Fung. **5**: 1065. 1887.

Known only from specimens collected by Oersted at Naranjo, Costa Rica. The species resembles *Galerula tenera*. There is a good colored figure at Copenhagen, but no specimens have been found.

21. **Atylospora fuliginosa** sp. nov.

Pileus hemispheric, not expanding, not umbonate, gregarious, 2 cm. broad and 1 cm. high; surface smooth, glabrous, hygrophanous, slightly striate, uniformly fuliginous, becoming somewhat paler on the disk; margin straight, eroded, concolorous; lamellae adnate, broad, ventricose, subcrowded, fuliginous, entire on the edges; spores usually ovoid, tapering at one end, smooth, purplish-brown, 7×4–$5\,\mu$; stipe equal or somewhat larger below, slender, smooth, glabrous, concolorous, whitish toward the base, 4–5 cm. long, 1.5–2 mm. thick.

Type collected in damp soil at Morce's Gap, near Cinchona, Jamaica, 1,500 m. elevation, December 29, 30, January 2, 1908–9, *W. A. & Edna L. Murrill 748* (herb. N. Y. Bot. Gard.). Also collected at the same time and place, *W. A. & Edna L. Murrill 680*.

4. PSATHYRELLA (Fries) Quél. Champ. Jura Vosg. 122. 1872

Agaricus § *Psathyrella* Fries, Epicr. Myc. 237. 1838.

Characterized by black spores and a straight, appressed margin when young. It is best known, perhaps, through its interesting little representative, *Psathyrella minutula*, which is widely distributed. A number of temperate species belong to this genus.

Pileus small, 2 cm. or less broad.	
Pileus white or gray.	
Spores tapering at the ends.	1. *P. minutula*.
Spores rounded at the ends.	2. *P. grisea*.
Pileus avellaneous.	
Pileus conic; solitary.	3. *P. mexicana*.
Pileus convex; cespitose.	4. *P. Earlei*.
Pileus reddish-brown to pale-rosy-isabelline.	5. *P. cubensis*.
Pileus large, 4–7 cm. broad.	6. *P. Stevensonii*.

1. **Psathyrella minutula** (Schaeff.)

Agaricus minutulus Schaeff. Fung. Bavar. 4: Ind. 72. 1774.
Agaricus disseminatus Pers. Syn. Fung. 403. 1801.
Psathyrella disseminata Quél. Champ. Jura Vosg. 123. 1872.

This very attractive little species was first described from Bavaria and accurately figured in color by Schaeffer. The synonymy is considerably complicated but it seems quite certain that the specific name under which the plant is best known has been in use since 1801, when Persoon extended his former use of this name to include the juvenile form as figured by Schaeffer in his plate 308.

The species appears to be cosmopolitan, or at least very widely distributed on decayed wood and moist earth containing organic matter, the caps often occurring in such large numbers in one spot that it would seem impossible to count them. *Psathyrella prona* is a European species somewhat similar in appearance but with much larger spores.

Xuchiles, near Cordoba, Mexico, *W. A. & Edna L. Murrill 1159*; Sumidero, Cuba, *Shafer 13913*.

2. **Psathyrella grisea** sp. nov.

Pileus very thin, small, conic to campanulate, not expanding, gregarious to subcespitose, 5–10 mm. broad and high; surface griseous, minutely whitish-floccose to subglabrous, distinctly striate to the disk; margin thin, concolorous, becoming irregular or splitting with age, incurved on drying; lamellae adnate, rather distant, very thin and fragile, becoming blackish with age; spores ellipsoid, rounded at both ends, smooth, dark-purplish-brown under the microscope, $7–8.5 \times 3.5–4.5\,\mu$; stipe filiform, slightly increasing toward the base, smooth, white, glabrous, 2–3 cm. long, 1 mm. or less thick.

Type collected on fallen dead sticks at Motzorongo, near Cordoba, Mexico, January 15, 1910, *W. A. & Edna L. Murrill 1077* (herb. N. Y. Bot. Gard.). A dainty little plant, reminding one of *Psathyrella minutula* and certain species of *Coprinus*. My field notes state that the pileus soon deliquesces.

3. **Psathyrella mexicana** sp. nov.

Pileus conic, not expanding, solitary, 1 cm. broad and high; surface hygrophanous, glabrous, rugose-striate, avellaneous, pale-

isabelline on the disk; margin straight, entire, concolorous; lamellae adnate, crowded, rather broad, grayish-white at first, becoming black with age; spores ellipsoid, smooth, opaque, dark-purplish-brown under the microscope, black in mass, $12 \times 7\,\mu$; stipe rather fragile, filiform, smooth, snow-white, mycelioid at the base, 4 cm. long, 1 mm. thick.

Type collected in humus in a moist, virgin forest at Motzorongo, near Cordoba, Mexico, January 15, 1910, *W. A. & Edna L. Murrill 1066* (herb. N. Y. Bot. Gard.).

4. **Psathyrella Earlei** sp. nov.

Pileus membranous, not deliquescent, convex, obtuse, cespitose, 1–2 cm. broad; surface hygrophanous, glabrous, crustose-rugose, grayish-brown, somewhat darker on the disk, paler when dry; margin concolorous, striate, not splitting on the backs of the lamellae, which are adnate, crowded, rather broad, avellaneous to blackish; spores broadly ellipsoid, smooth, opaque, dark-brown under the microscope, black in mass, $10–12 \times 8–9\,\mu$; stipe slender, equal, tubular, glabrous, minutely pubescent at the apex, white with a brownish tint, cartilaginous, 5–7 cm. long, 1–1.5 mm. thick.

Type collected on buried wood in a banana field at Santiago de las Vegas, Cuba, June 18, 1904, *F. S. Earle 96* (herb. N. Y. Bot. Gard.).

5. **Psathyrella cubensis** sp. nov.

Pileus thin, campanulate to expanded, sometimes upturned at the margin with age, gregarious, 1–1.5 cm. broad; surface glabrous, hygrophanous, sometimes rugose, reddish-brown to pale-rosy-isabelline; margin concolorous, striate, becoming irregular or fluted; lamellae adnate or adnexed, broad, ventricose, rather crowded, at first pallid, becoming dark-purplish-brown or almost black; spores very broadly ellipsoid, opaque, uniguttulate, chestnut-colored under the microscope, black in mass, $9–12 \times 7–8\,\mu$; stipe filiform, glabrous, smooth, white and farinaceous at the apex, reddish below, 3–5 cm. long, 1 mm. thick.

Type collected in clay soil in a banana field at Santiago de las Vegas, Cuba, June 18, 1904, *F. S. Earle 98* (herb. N. Y. Bot. Gard.). Also collected by Van Herman in the same locality, September 8, 1904, *F. S. Earle 172*.

6. **Psathyrella Stevensonii** sp. nov.

Pileus conic or campanulate to convex and finally expanding, more or less umbonate, gregarious to subcespitose, 4–7 cm. broad; surface hygrophanous, distinctly sulcate-striate to the disk, brown or chestnut at first, fading to cinereous or isabelline, covered with prominent, white, floccose scales when young, at length glabrous; margin appressed when young, splitting with age; context with mild flavor and pungent, rather pleasant odor; lamellae adnexed, crowded, rather narrow, pallid to almost black, not deliquescing; spores ellipsoid, smooth, opaque, dark-chestnut under the microscope, black in mass, about $11 \times 6\,\mu$; stipe tapering upward, white, shining, hollow, glabrous or whitish-floccose, 7–10 cm. long, 3–8 mm. thick; veil white, scanty, soon evanescent.

Type collected in garden soil at Rio Piedras, Porto Rico, June, 1915, *J. A. Stevenson 2785* (herb. N. Y. Bot. Gard.). Also collected in chip dirt in a yard at Herradura, Cuba, October 10, 1906, *F. S. Earle 546,* and in a door-yard at the same place, November 3, 1906, *F. S. Earle 558.* This plant is rather large and the stipe rather thick for *Psathyrella,* but it cannot go into *Coprinus* because the lamellae do not deliquesce. This character was carefully noted by Stevenson. At first sight, one is reminded of *Coprinus micaceus,* which is smaller, more clustered, and has much smaller spores. Cooke's figure of *Psathyrella arata* represents the form of the plant fairly well.

DOUBTFUL SPECIES

Psathyrella hiascens (Fries) Quél. Champ. Jura Vosg. 123. 1872. (*Agaricus hiascens* Fries, Syst. Myc. **1**: 303. 1821.) Described from specimens collected on the ground in humid woods in Europe and reported by Peck from New York. Specimens collected in Costa Rica by Oersted were referred to this species by Fries, but it is very probable that they are distinct. Oersted's figures represent a densely cespitose plant with hemispheric pileus, totally different from the campanulate, umbonate pileus shown in Bulliard's and Cooke's figures. Unfortunately, there are no specimens extant from which spores might be obtained. This species was also reported from Dominica by Miss A. L. Smith, but I have not seen the specimens.

Psathyrella modesta (Berk.) Sacc. Syll. Fung. **5**: 1133. 1887. (*Agaricus modestus* Berk. Lond. Jour. Bot. **1**: 453. 1842.) Described from specimens collected by Hinds on stumps in New Guinea. Reported from St. Vincent by Massee in 1892. I have not examined Massee's specimens.

5. PSILOCYBE (Fries) Quél. Champ. Jura Vosg. 116. 1872

Agaricus § *Psilocybe* Fries, Syst. Myc. **1**: 289. 1821.

This difficult genus differs from *Atylospora* in having the margin of the pileus incurved when young, and from *Campanularius* in having purplish-brown instead of black spores. It is well represented in temperate regions.

Pileus white, becoming brown; stipe white to fulvous.	1. *P. palmigena.*
Pileus rosy-isabelline; stipe subconcolorous.	2. *P. orizabensis.*
Pileus fulvous; stipe white.	3. *P. dichroma.*
Pileus brown; stipe concolorous.	4. *P. plutonia.*

1. PSILOCYBE PALMIGENA (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1049. 1887.

Agaricus palmigena Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.

Collected only once by Wright on palm stumps in woods in Cuba. The spores are ellipsoid or ovoid, smooth, distinctly purplish-brown under the microscope, 7×4–$5\,\mu$. The lamellae are described as free, while the type specimens are too poorly preserved to show their attachment.

2. **Psilocybe orizabensis** sp. nov.

Pileus conic, not expanding, not umbonate, solitary, 1.5 cm. broad and high; surface smooth, glabrous, not striate, uniformly rosy-isabelline; margin entire, concolorous; lamellae adnate, crowded, broad, whitish at first, becoming dark-isabelline with a rosy tint; spores oblong-ellipsoid, smooth, opaque, dark-chestnut under the microscope, about $12 \times 6\,\mu$; stipe slightly larger below, smooth, glabrous, paler than the pileus, rather brittle, 5 cm. long, 1.5–2 mm. thick.

Type collected in soil at Orizaba, Mexico, 1,200 m. elevation, January 10–14, 1910, *W. A. & Edna L. Murrill 771* (herb. N. Y. Bot. Gard.).

3. PSILOCYBE DICHROMA (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1057. 1887

Agaricus dichromus Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.

Known only from specimens collected by Wright on dead wood in Cuba. The spores are broadly ovoid, smooth, opaque, distinctly purplish-brown under the microscope, $7 \times 4–5\ \mu$.

4. PSILOCYBE PLUTONIA (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1056. 1887

Agaricus plutonius Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.

Known only from Wright's single collection on decayed wood in Cuba. The spores were described as subglobose, but are now distinctly angular, as in *Entoloma,* decidedly purplish-brown under the microscope, uniguttulate, $4\ \mu$ in diameter. If this angularity is not due to shrinkage, the species is readily distinguished by it and is quite anomalous. *Psathyra cubispora,* which occurs on moist ground in South America, may be referred to in this connection.

DOUBTFUL SPECIES

Psilocybe subviridis (Berk. & Curt.) Sacc. Syll. Fung. **5**: 1051. 1887. (*Agaricus subviridis* Berk. & Curt. Jour. Linn. Soc. **10**: 292. 1868.) Described from specimens collected by Wright on decayed wood in Cuba. The types at Kew are rather poor and the description omits many important characters, such as taste, and the color of the context and lamellae; but the spores are ellipsoid or ovoid, smooth, very pale purplish-brown with a yellowish tint under the microscope, $7 \times 4\ \mu$.

6. CAMPANULARIUS Roussel, Fl. Calvados ed. 2. 64. 1806

Agaricus § *Panaeolus* Fries, Epicr. Myc. 234. 1838.
Panaeolus Quél. Champ. Jura Vosg. 121. 1872.
Anellaria P. Karst. Bidr. Finl. Nat. Folk **32**: 517. 1879.
Chalymota P. Karst. Bidr. Finl. Nat. Folk **32**: 518. 1879.

This genus, which is better known as *Panaeolus,* is characterized by its black, usually lemon-shaped, spores, cartilaginous stipe,

incurved margin, and non-deliquescent lamellae. The species generally occur on manure and are therefore very widely distributed, both in temperate and tropical regions, although the genus is not a large one.

Stipe reddish-brown, hollow, 2–4 mm. thick.	1. *C. campanulatus.*
Stipe white, solid, 4–8 mm. thick.	2. *C. solidipes.*
Stipe stramineous, only 4 cm. long.	3. *C. anomalus.*

1. CAMPANULARIUS CAMPANULATUS (L.) Earle, Bull. N. Y. Bot. Gard. **5**: 434. 1909

Agaricus campanulatus L. Sp. Pl. 1175. 1753.

Agaricus papilionaceus Bull. Herb. Fr. *pl. 561, f. 2*; hyponym. 1791; Pers. Syn. Fung. 410. 1801.

Panaeolus campanulatus Quél. Champ. Jura Vosg. **1**: 122. 1872.

This species is common and widely distributed on manure or manured ground throughout temperate and tropical America, as well as Europe. The spores are like those of *C. solidipes,* but smaller.

Bermuda, *Brown, Britton, & Seaver 1307, 1346, 1458, 1477, 1517*; Bahamas, *Britton & Millspaugh 2503*; Cuba, *Wright;* Santiago de las Vegas, Cuba, *Earle 34*; Rio Piedras, Porto Rico, *Fink 550*; Cockpit Country, Jamaica, *Murrill & Harris 1072*; Guadeloupe, *Duss;* Grenada, *Broadway;* British Honduras, *Peck;* Jalapa, Mexico, *Murrill 108, 151, 177.*

2. **Campanularius solidipes** (Peck)

Agaricus solidipes Peck, Ann. Rep. N. Y. State Cab. **23**: 101. 1872.

Panaeolus solidipes Sacc. Syll. Fung. **5**: 1123. 1887.

This species was described from specimens collected at West Albany, New York. It is the largest and commonest species of this genus in tropical America, occurring on horse manure in pastures or along roadways. The spores are lemon-shaped, smooth, black, opaque, about $17 \times 12 \mu$. Several species seem to have been confused with this by the older mycologists.

Santiago de las Vegas, Cuba, *Earle 22, 158*; Hope Gardens, Jamaica, *Earle 199, 326*; Cinchona, Jamaica, *Underwood 3173*;

Stanmore Hill, Jamaica, *Mrs. Britton, 468*; Halls Delight, Jamaica, *Earle 113*; Utuado, Porto Rico, *Britton & Cowell 1239*; Mayagüez, Porto Rico, *Fink 919*; Aibonito, Porto Rico, *Fink 1979*; Grenada, *Broadway*.

3. **Campanularius anomalus** sp. nov.

Pileus convex, not fully expanding, the entire hymenophore becoming caesious to ardesiacous when bruised, gregarious, 2 cm. broad; surface smooth, uniformly stramineous, the cuticle cracking with age; margin entire, concolorous, inflexed when young; context white, rather thick; lamellae adnate or adnexed, broad, subcrowded, soon becoming black; spores lemon-shaped, smooth, opaque, perfectly black under the microscope, 10–12 $\times$ 9 μ; stipe cylindric, equal, rather short, smooth, concolorous, hollow, 4 cm. long, 2.5 mm. thick; veil wanting.

Type collected among grass in a rich pasture in Troy, Cockpit Country, Jamaica, 800 m. elevation, January 12–14, 1909, *W. A. Murrill & W. Harris 1082*. This species differs decidedly from other members of the genus, but there seems to be no other place for it.

DOUBTFUL SPECIES

Panaeolus fimicola (Fries) Quél. Champ. Jura Vosg. **1**: 239. 1872. (*Agaricus fimicola* Fries, Syst. Myc. **1**: 301. 1821.) Reported from Guadeloupe and Martinique by Duss, but possibly confused with *C. solidipes*.

Panaeolus papilionaceus (Fries) Quél. Champ. Jura Vosg. **1**: 122. 1872. (*Agaricus papilionaceus* Fries, Epicr. Myc. 236. 1838. Not *A. papilionaceus* Pers. Syn. Fung. 410. 1801.) Described from specimens collected in Europe. Reported from Bermuda and St. Vincent, but possibly confused with *C. campanulatus* or *C. solidipes*.

Panaeolus phalenarum (Fries) Quél. Champ. Jura Vosg. **1**: 121. 1872. (*Agaricus phalenarum* Fries, Epicr. Myc. 235. 1838.) Reported from Cuba and St. Thomas, but possibly confused with *C. solidipes*.

Psilocybe antillarum (Fries) Sacc. Syll. Fung. **5**: 1052. 1887. (*Agaricus antillarum* Fries, Elench. Fung. **1**: 42. 1828.) De-

scribed from specimens collected among straw on the island of St. Croix, Danish West Indies. Specimens collected later on the same island by Oersted were referred to this species by Fries as variety *praelonga;* and the figure of this variety at Copenhagen, drawn by Oersted, is the only thing I have found outside of the description to throw light upon the species.

The figure reminds me very forcibly of *Paneolus solidipes* Peck. The description of the species refers to the solid stipe and to the fact that the pileus sometimes becomes areolate-corrugate, but the surface is said to be yellow or white in alcohol, while the drawing of the variety shows it to be avellaneous, and in *P. solidipes* it is white. Fries evidently put his species in the genus *Psilocybe* because of the "livid-black" lamellae, although he described the spores as black. If type specimens were available, the spores could be examined and the whole question settled.

Psilocybe fortunata (Cooke) Sacc. Syll. Fung. **5**: 1056. 1887. (*Agaricus fortunatus Cooke, Grevillea* 9: 100. 1881.) Described from specimens collected on the ground at Rio de Janiero, Brazil, by Glaziou, and reported from St. Vincent by Massee, who may have confused it with *C. solidipes,* the spores of the two being the same. Unfortunately, the color of *P. fortunata* is not given.

NEW COMBINATIONS

For the convenience of those who prefer the older nomenclature, the following species described as new in *Atylospora* are transferred to *Psathyra:*

ATYLOSPORA ALBIPES	= **Psathyra albipes**
ATYLOSPORA BYSSINA	= **Psathyra byssina**
ATYLOSPORA CINCHONENSIS	= **Psathyra cinchonensis**
ATYLOSPORA CUBENSIS	= **Psathyra cubensis**
ATYLOSPORA DIMINUTIVA	= **Psathyra diminutiva**
ATYLOSPORA FULIGINOSA	= **Psathyra fuliginosa**
ATYLOSPORA LATERITIA	= **Psathyra lateritia**
ATYLOSPORA MAMMILLATA	= **Psathyra mammillata**
ATYLOSPORA MEXICANA	= **Psathyra mexicana**
ATYLOSPORA PALLIDISPORA	= **Psathyra pallidispora**
ATYLOSPORA PLANA	= **Psathyra plana**

NEW YORK BOTANICAL GARDEN.

RUSTS AND SMUTS COLLECTED IN NEW MEXICO IN 1916[1]

Paul C. Standley

During August and September, 1916, the writer spent four weeks at Ute Park, Colfax County, New Mexico. This locality is in the extreme northern part of the State, 60 miles southwest of Raton, and not far from the Colorado boundary. The altitude of the station is approximately 2350 meters, and the mountains in the vicinity reach an elevation of 3650 meters. The region is typical of many others in the southern Rockies. Ute Park lies about on the border between the Upper Sonoran and Transition zones. The Upper Sonoran vegetation, confined to the lower levels and drier hillsides, is characterized by pinyon and cedar, while the Transition vegetation, of the more elevated mountain sides, is dominated by the Rocky Mountain yellow pine. At higher levels the Canadian Zone, with its heavy forests of fir and Douglas and other spruces, is extensively represented, and on the highest peaks there is a well developed Arctic-Alpine Zone.

While the writer was interested primarily in the flowering plants, he devoted a large part of his time to the systematic collection of cryptogams, especially rusts. Of the latter nearly a hundred numbers were collected, 17 of which represent species new to the State,[2] while many others are the basis of new host records for New Mexico. In all 55 species of Uredinales were collected. The writer is inclined to believe that this number includes most of the representatives of the rust flora of the locality at this particular season.

In the following list the species formally listed are either new to the State (indicated by an asterisk) or are reported here upon hosts hitherto unrecorded for New Mexico. A few new

[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] See Paul C. Standley, Fungi of New Mexico, Mycologia **8**: 142–177. 1916.

records are included from sources other than the writer's collections, but unless otherwise noted all the material was obtained at Ute Park. The numbers in parenthesis are the writer's collection numbers, specimens of which are deposited in the U. S. National Herbarium.

For the identifications of the rusts as well as for other assistance in the preparation of the present paper, the writer is deeply indebted to Dr. J. C. Arthur. The Ustilaginales have been determined by Mr. H. R. Rosen, formerly of the U. S. National Herbarium.

UREDINALES

*ALLODUS COMMUTATA (Syd.) Arthur

Reported from New Mexico, upon *Valeriana* sp. by Orton.[3]

*ALLODUS DOUGLASII (Ellis & Ev.) Orton

Reported from New Mexico, upon *Phlox* sp., by Orton.[4]

*ALLODUS VERTISEPTA (Tracy & Gall.) Arthur

[*Puccinia vertisepta* Tracy & Gall. Jour. Myc. 4:21. 1888].

The type was collected in New Mexico, on "*Salvia ballotaeflora.*"

COLEOSPORIUM RIBICOLA (Cooke & Ellis) Arthur
[*Peridermium ribicola* Long]

On *Ribes aureum* Pursh (13309), *R. inebrians* Lindl. (13669), and *Grossularia inermis* (Rydb.) Cov. & Britt. (13728). These are all new hosts for the State. Also found at Ute Park on *Ribes Wolfii* Rothr. (14165). In the North American Flora this rust is not reported on either *Grossularia inermis* or *Ribes Wolfii*. In the case of the latter host the writer was able to find only a single rusted leaf, but on the other hosts the rust was extremely abundant.

Long[5] reports the aecial stage of this rust from the Sandia Mountains on *Pinus edulis* Engelm. He also reports the coleo-

[3] Mem. N. Y. Bot. Gard. 6: 204. 1916.
[4] Mem. N. Y. Bot. Gard. 6: 199. 1916.
[5] Mycologia 8: 309–311. 1916.

sporial stage from the Santa Fe National Forest, on *Ribes mescalerium* Coville. The host is probably rather *R. inebrians* Lindl., for *R. mescalerium,* so far as known to the writer from collections, is confined to the southern part of the State. In addition, Mr. Long reports the coleosporial stage from Albuquerque, on *Ribes "longifolium"* [*longiflorum?*], a name doubtless to be corrected to *R. aureum.* *R. longiflorum* is not known to occur in New Mexico.

CRONARTIUM COLEOSPORIOIDES (Diet. & Holw.) Arthur

On *Pedicularis Grayi* A. Nels., a new host record for the State (14270). Also on *Castilleja sulphurea* Rydb. (with *Puccinia Andropogonis* Schw.) (14075), *C. linariaefolia* Benth. (14275), and *C. integra* Gray (14712).

*GYMNOSPORANGIUM BETHELI Kern

I. On *Crataegus erythropoda* Ashe (13384). II. On *Juniperus scopulorum* Sarg. (14619). Prolonged search failed to reveal more than a single " cedar apple."

MELAMPSORA BIGELOVII Thüm.

New host records for the State are *Salix cordata Watsoni* Bebb (13564) and *S. subcaerulea* Piper (13758). The latter appears to be a new host for the species.

Dr. Arthur writes that the hosts of two collections reported by the writer[6] as on *Salix* sp. have now been determined as follows: *Standley* 7713, from the Tunitcha Mts., is on *S. Scouleriana* Barratt; and *Standley* 7161, from Farmington, is on *S. Wrightii* Anderss.

MELAMPSORA LINI (Schum.) Desmaz.

II, III. On *Cathartolinum australe* (Heller) Small, a new host for the species (14091, 14543). Also on *Linum Lewisii* Pursh (13864).

*PHRAGMIDIUM ANDERSONI Shear

On *Dasiphora fruticosa* (L.) Rydb. (13321).

[6] Mycologia 8: 153. 1916.

PHRAGMIDIUM MONTIVAGUM Arthur

A new host for the State is *Rosa Maximiliani* Nees (13308, 14587); also on *R. Fendleri* Crép. (14649).

PHRAGMIDIUM PECKIANUM Arthur

Heretofore this rust and its host, *Oreobatus deliciosus* (James) Rydb., have been known in New Mexico only from Sierra Grande. Both were abundant on the dry hills about Ute Park (13697).

PUCCINIA ABSINTHII DC.

III. On *Artemisia dracunculoides* Pursh (13666), a new host for the State. Also on *A. redolens* Gray (13894).

In the writer's previous list of New Mexican rusts[7] a species "*Puccinia Artemisiae* DC." was cited. There is no such species, the name having been a slip of the pen for *P. Absinthii* DC., and the collections enumerated should be referred to the latter species.

*PUCCINIA AEMULANS Sydow

II, III. On *Gymnolomia multiflora* (Nutt.) Benth. & Hook. (13651).

*PUCCINIA ANDROPOGONIS Schw.

[*Aecidium micropunctum* Ellis & Ev.]

On *Castilleja sulphurea* Rydb. (with *Cronartium coleosporioides*) (14075a), *Andropogon scoparius* Michx. (with *Puccinia Ellisiana*), II (13575), and *Pentstemon Torreyi* Benth., I (14182).

*PUCCINIA ASTERIS Duby

On *Aster Wootonii* Greene (14063).

PUCCINIA CIRSII Lasch.

On *Cirsium ochrocentrum* Gray (13304, 13570) and *C. coloradense* (Rydb.) Cockerell (13561), both new hosts for the State.

PUCCINIA CLEMATIDIS (DC.) Lagerh.

New hosts for the State are *Bromus ciliatus* L., III (13652), *Agropyron tenerum* Vasey, II, III (13682), and *Bromus Porteri*

[7] Mycologia 8: 156. 1916.

(Coult.) Nash (14524). Also found on *Elymus canadensis* L., II, III (13798), and *Clematis ligusticifolia* Nutt., I (13885).

*PUCCINIA CLINTONII Peck

On *Pedicularis fluviatilis* Heller (14485).

*PUCCINIA CONFERTA Diet. & Holw.

On *Artemisia albula* Wooton: Organ Mts., Aug. 16, 1895, *Wooton.*

PUCCINIA ELLISIANA Thüm.

II, III. On *Andropogon scoparius* Michx. (with *Puccinia Andropogonis*) (13575). Reported from New Mexico previously (I) on *Viola pedatifida* Don.

*PUCCINIA EPIPHYLLA (L.) Wettst.

II. On *Poa Bigelovii* Vasey & Scribn. (13673, 13890) and *P. pratensis* L. (13892).

*PUCCINIA GENTIANAE (Str.) Link

On *Dasystephana Bigelovii* (Gray) Rydb. (13865).

PUCCINIA GROSSULARIAE (Schum.) Lagerh.

II. On *Carex nebraskensis* Dewey (13905). Only the aecial stage reported from the State previously.

*PUCCINIA HIERACII (Schum.) Mart.

On *Hieracium Fendleri* Gray (13361).

*PUCCINIA KUHNIAE Schw.

On *Kuhnia rosmarinifolia* Vent. (14116).

PUCCINIA MENTHAE Pers.

A new host for the State is *Monarda comata* Rydb. (13312, 14632). Also on *Monarda stricta* Wooton, II, III (14074, 14741).

*PUCCINIA MILLEFOLII Fckl.

On *Achillea lanulosa* Nutt. (14077).

PUCCINIA MUHLENBERGIAE Arth. & Holw.

II, III. On *Muhlenbergia trifida* Hack. (13663, 14525), a new host for the State.

PUCCINIA POCULIFORMIS (Jacq.) Wettst.

II, III. On *Agropyron tenerum* Vasey (13959) and *Triticum aestivum* L. (14590), both new host records for New Mexico.

PUCCINIA PSEUDOCYMOPTERI Holway

II, III. On *Pseudocymopterus multifidus* Rydb. (13655). Reported from the State previously on *P. montanus*.

*PUCCINIA SAXIFRAGAE Schlecht.

On *Micranthes arguta* (Don) Small (13642) and *Heuchera parvifolia* Nutt., III (13804).

PUCCINIA SHERARDIANA Körn.

On *Malvastrum coccineum* (Pursh) Gray (14566), a new host for the State.

*PUCCINIA SUBDECORA (Syd.) Holway

I. On *Coleosanthus grandiflorus* (Hook.) Kuntze (13383).

*PUCCINIA SUBSTERILIS Ellis & Ev.

On *Stipa Vaseyi* Scribn. (13574) and *S. Scribneri* Vasey, II, X (14594).

*PUCCINIA TARDISSIMA Garrett

On *Arenaria Fendleri* Gray (13580).

PUCCINIA TUBERCULANS Ellis & Ev.

A new host for the State is *Sideranthus spinulosus* (Pursh) Sweet (14445).

PUCCINIA UNIVERSALIS Arthur

I. On *Artemisia gnaphalodes* Nutt. (13352). II, III. On *Carex Douglasii* Boott (13578, 14442). Both are new hosts for the State, the only previous record being the aecial stage on *Artemisia franserioides*.

PUCCINIA VIOLAE (Schum.) DC.

Dr. Arthur writes that a specimen in the herbarium of the New York Botanical Garden, probably on *Viola pedatifida* Don, was collected at the mouth of Sapello Canyon, September, 1901, by Prof. T. D. A. Cockerell.

UROMYCES FABAE (Pers.) De Bary

On *Lathyrus decaphyllus* Pursh (13741) and *L. arizonicus* Britton (13774), new hosts for the State. Also on *Lathyrus leucanthus* Rydb., II, III (13645) and *Vicia americana* Muhl. (14424).

UROMYCES GENTIANAE Arthur

II. On *Amarella strictiflora* (Rydb.) Greene (13778). Reported from the State previously on *A. heterosepala*.

*UROMYCES GRAMINICOLA Burrill

II, III. On *Panicum virgatum* L. (13685). In the North American Flora this rust is not reported from west of Kansas and Oklahoma.

*UROMYCES HEDYSARI-OBSCURI (DC.) Wint.

II, III. On *Hedysarum pabulare* A. Nels. (13394).

UROMYCES INTRICATUS Cooke

[*U. Eriogoni* Ellis & Hark.]

A new host for the State is *Eriogonum Jamesii* Benth. (13800). Also on *E. racemosum* Nutt. (14711), only a single rusted leaf found after much search; usually the rust is very abundant on this species in New Mexico.

UROMYCES PROEMINENS (DC.) Pass.

II. On *Poinsettia dentata* (Michx.) Klotzsch & Garcke, at Raton (13261), a new host for the State. Also on *Chamaesyce serpyllifolia* (Pers.) Small, II, III (14233).

UROMYCES PUNCTATUS Schroet.

[*U. Astragali* Sacc.]

A new host for New Mexico is *Oxytropis deflexa* (Pall.) DC. (13860).

The following additional rusts were collected at Ute Park, all on hosts upon which they have been found in the State previously: *Aecidium Compositarum* Auct., on *Dugaldea Hoopesii* (Gray) Rydb. (13756); *Melampsora albertensis* Arthur, on *Populus aurea* Tidestrom, apparently scarce (14550); *Phragmidium imitans* Arthur, on *Rubus arizonicus* (Greene) Rydb. (14650); *Phragmidium Potentillae* (Pers.) P. Karst., II, III, on *Potentilla strigosa* Pall. (13916); *Puccinia Grindeliae* Peck, on *Grindelia aphanactis* Rydb. (13639, 14589); *Puccinia Helianthi* Schw., on *Helianthus annuus* L., very scarce, although sunflowers grew everywhere (14467); *Puccinia hemispherica* Peck, III, on *Lactuca pulchella* (Pursh) DC. (13569, 14257); *Puccinia Oxalidis* (Lev.) Diet. & Ellis, on *Ionoxalis violacea* (L.) Small (14691); *Puccinia Taraxaci* Plowr., on *Taraxacum taraxacum* (L.) Karst. (14581); *Pucciniastrum Agrimoniae* (Schw.) Tranz., II, on *Agrimonia striata* Michx. (14643); *Pucciniastrum pustulatum* (Pers.) Dietel, II, on *Epilobium novomexicanum* Hausskn. (13903); *Uromyces Rudbeckiae* A. & H., on *Rudbeckia laciniata* L. (13735); *Uropyxis sanguinea* (Peck) Arthur, on *Odostemon repens* (Lindl.) Cockerell (13585).

USTILAGINALES

USTILAGO BROMIVORA (Tul.) Fisch. de Waldh.

A new host for the State is *Bromus Richardsoni* Link (14148). Also on *B. polyanthus* Shear (13797).

*USTILAGO CRUS-GALLI Tracy & Earle

On *Echinochloa zelayensis* (H.B.K.) Schult. (14784). Apparently a new host for the species.

USTILAGO HORDEI (Pers.) Kell. & Swingle

On *Hordeum trifurcatum* Jacq., cultivated (13796).

USTILAGO HYPODYTES (Schlecht.) Fr.

On *Sitanion longifolium* J. G. Smith (14114), a new host for the State. Also on *Stipa Vaseyi* Scribn. (14703).

Ustilago levis was collected also, abundant on cultivated oats (14440).

UNITED STATES NATIONAL MUSEUM,
WASHINGTON, D. C.

A PHYLLACHORA OF THE ROYAL PALM

John R. Johnston and Stephen C. Bruner

(With Plate 2, Containing 2 Figures)

Recently while examining some royal palms (*Roystonea regia* Cook) near Rincón, Cuba, the writers were attracted by a fungus which formed conspicuous black, carbonaceous masses several centimeters long on the midribs of the leaves. These masses were seen to be made up of more or less confluent groups of stromata developed in a closely crowded condition beneath the epidermis of the host. The fungus was also present on the leaf-segments but here the growth was more restricted and less conspicuous than on the midrib.

A study of this fungus showed it to be a *Phyllachora* and, so far as could be determined from an examination of the available literature, distinct from any previously described species. It is distinguished from the other species occurring on the Palmae chiefly by the large size of its asci.

The economic importance of the fungus appears to be slight. It has as yet been observed on only a few plants and the damage to these was not serious. A technical diagnosis is offered, as follows:

Phyllachora Roystoneae sp. nov.

Stromata subcutaneous, united to parenchyma and epidermis, black, carbonaceous, gregarious, collected in elongate, subconfluent to confluent groups commonly 2–5 cm × 1–6 mm., the separate stromata subcircular to elliptic, convex to conic-convex, commonly 0.3 to 1 mm. in diameter, phyllogenous; perithecia formed as locules in the stroma, subglobose, crowded, in one layer, 260–430 μ in diameter, the ostioles erumpent, indistinct or slightly papilliform; asci clavate, rounded or subapplanate at the apex stipitate, 116–186 × 12–20 μ, eight-spored; paraphyses absent or soon evanescent; spores irregularly monostichous to subdistichous, fusiform, sub-acute at each end, hyaline, thin-walled, stuffed

with granular protoplasm, frequently several-guttulate, 22–28.4 × 8–10 μ.

Habitat on living leaves of *Roystonea regia* Cook, Rincón, Havana, Cuba.

ESTACIÓN EXPERIMENTAL AGRONÓMICA,
SANTIAGO DE LAS VEGAS, CUBA.

EXPLANATION OF PLATE 2

Phyllachora Roystoneae Johnston & Bruner

FIG. 1. A. Perithecia in section, much enlarged.
B. A single ascus, showing the spores in outline.
C. Ascospores in outline, also much enlarged.

FIG. 2. A, B, C. Different views of the stromata as seen on the host, natural size and somewhat enlarged.

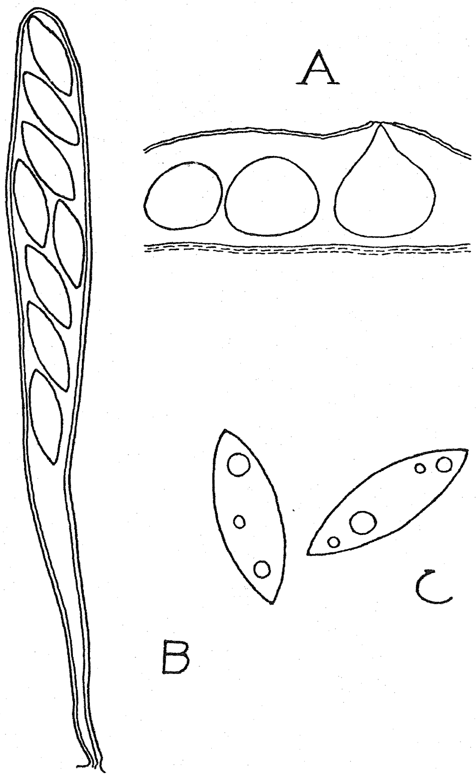


FIG. 1

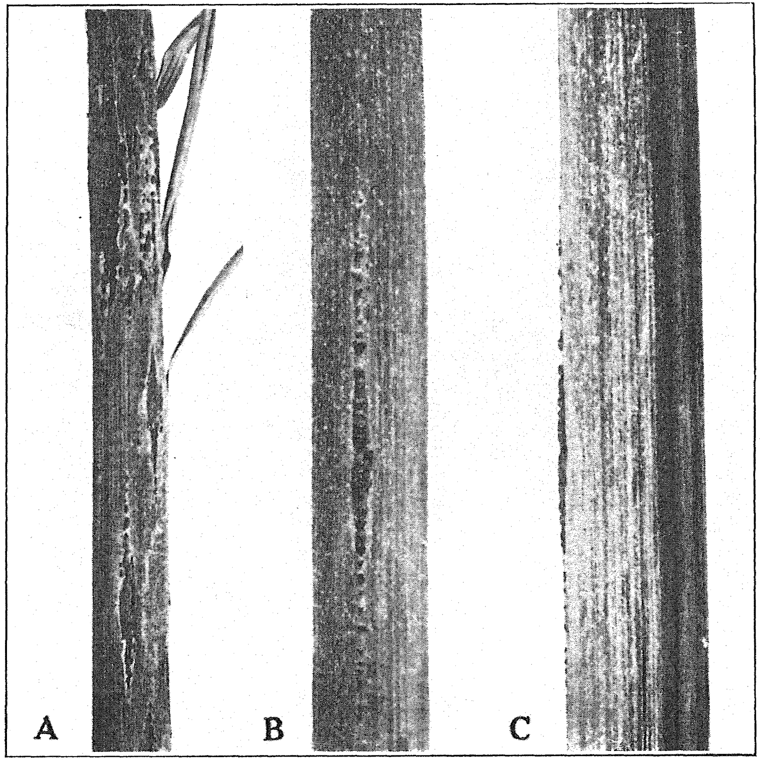


FIG. 2

PHYLLACHORA ROYSTONEAE JOHNSTON & BRUNER

NOTES AND BRIEF ARTICLES

Dr. J. F. Brenckle, of Kulm, North Dakota, an enthusiastic collector and frequent contributor to *Mycologia* has entered the United States service and at the present writing is located at the War Prison Hospital, Fort Douglas, Utah.

A long list of fungi collected on Long Island and Gardiner's Island appeared in *Torreya* for July, 1917, contributed by Stewart H. Burnham and Roy A. Latham.

Professor George F. Atkinson, of Cornell University, attended the Torrey Club Anniversary and remained at the Garden for some weeks consulting the mycological herbarium with special reference to the large numbers of types of gill-fungi which it contains.

An excellent edible mushroom, *Boletus luteus*, with tubes instead of gills, has become established under the young pine trees east and north of Conservatory Range 1. This was noticed last year, but the spawn has spread very considerably since that time.

In a pamphlet published in 1916 by the Indian Tea Association, A. C. Tunstall describes and gives treatment for root diseases of the tea plant caused by *Diplodia, Rosellinia, Hymenochaete noxia, Fomes lucidus, Ustulina zonata,* and *Thyridaria tarda*.

A needle blight of Douglas fir is described by J. R. Weir in the *Journal of Agricultural Research* for July. The disease has been found throughout the Northwest. The identity of the fungus has not been determined, but it apparently belongs to the Stictidaceae.

Black rootrot, a destructive disease to apple trees in Virginia, has been attributed by F. D. Fromme and H. E. Thomas largely to the work of the fungus *Xylaria Hypoxylon*. There is also

some evidence that other species of the genus may also be slightly pathogenic.

Endrot of cranberries is claimed by C. L. Shear to be caused by a sphaeropsidaceous fungus, which is described by him under the name of *Fusicoccum putrefaciens* and is suspected of being the pycnidial form of a *Cenangium* resembling *Cenangium urceolatum*.

The perfect stage of *Gloeosporium venetum*, a fungus causing a disease of raspberries, is described in *Phytopathology* by W. H. Burkholder as *Plectodiscella veneta*. The fungus appears to belong to the *Myriangaceae*.

An article on the Taxonomy of the Agaricaceae, by William A. Murrill, which appeared in the *American Journal of Botany* for June, 1917, contains notes on collecting, preserving, and arranging fleshy or other bulky fungi in the herbarium.

A very useful condensed list of rose pests and their treatment may be found in the first number of the *Journal of the International Garden Club*, published in August, 1917. This number also contains some general notes on sprays and washes for decorative plants.

Dr. C. H. Kauffman, who is preparing manuscript on certain genera of the gill-fungi for *North American Flora*, spent a very successful vacation in the Rocky Mountains, where he made large collections of *Cortinarius*. He is now on leave for a year from the University of Michigan and is connected with the Federal Horticultural Board, with headquarters in Washington.

Para rubber trees in the Federated Malay States have recently been subject to attack by *Ustulina zonata*, which causes a dry-rot disease of the collar and root of this tree. It is suggested that diseased portions and wounds should be thoroughly cleaned and covered with some preservative.

The pink disease of cacao, according to J. B. Rorer, is caused wherever found by *Corticium salmonicolor*, which occurs in the

Orient on 141 different plants. In case of scattered infections, removal of diseased wood is said to be effective; but where the fungus has become established it is necessary to treat with tar.

The Commission of Plant Sanitation of Cuba has recently published its first bulletin, giving an account of its organization and work. This bulletin contains a list of plant diseases in Cuba; the budrot of the cocoanut and its control; and the banana disease and its control. Professor J. R. Johnston, who is president of the Commission and pathologist of the experiment station, has contributed most of the material for this bulletin.

A specimen of *Cycloporus Greenei* (Berk.) Murrill has recently been given to the Garden by Miss Eleanor Hodges, who collected it several years ago under rhododendrons at Pocono Manor, Pennsylvania. Miss Hodges knew that it was a rare fungus and was surprised to find it four or five times in different places in the vicinity of Pocono Manor. This interesting species is represented in the Garden herbarium by sporadic collections from New England to the mountains of North Carolina and west to Iowa, but Miss Hodges' collection is the first we have received from the state of Pennsylvania.

Since the completion of Volume 9 of *North American Flora,* many requests have come in for parts 1 and 2, dealing with the polypores, which were exhausted in separate several years ago. In order to supply the lack of these parts, Dr. Murrill published his series of books, entitled "Northern Polypores," "Southern Polypores," "Western Polypores," "Tropical Polypores," and "American Boletes." He is now preparing a small pamphlet containing the equivalents of his names in Saccardo's nomenclature, so that those using Saccardo's work may not be confused by the changes he has made. The pamphlet will appear in February, and may be obtained direct from the author for twenty cents by any reader of *Mycologia.*

A list of the Hymenomycetes of Rochester (New York) and vicinity, by Dr. Fred S. Boughton, has recently appeared in the

Proceedings of the Rochester Academy of Science. There are 319 species and varieties in the list, all collected by Mr. Boughton and most of them determined by Professor Peck. Interesting notes on occurrence, edibility, etc., are added. *Amanitopsis volvata* Peck is cited as an edible species, whereas Ford and others have found it to be poisonous. See *Mycologia* 6: 174. 1914. *Amanita Frostiana* is probably harmless, but it too closely resembles *A. muscaria* to recommend it for food.

Polyporus amorphus Fries, which was referred to in *Mycologia* for January, 1916, and discussed quite fully in *Mycologia* for September, 1917, is represented in the Garden herbarium by two additional collections which have not been previously mentioned specifically. One is from Penobscot Lake, Somerset County, Maine, collected on decaying *Abies balsamea*, August 25, 1903, by E. R. Hodson, *187*; and the other is from State College, Pennsylvania, collected on a stump of *Pinus Strobus*, November 27, 1914, by C. R. Orton and A. S. Rhoads, *14*. The first mentioned collection appears to add a new host for America, the fungus having been reported hitherto on three species of pine, *P. rigida, P. Strobus,* and *P. pungens,* and on hemlock.

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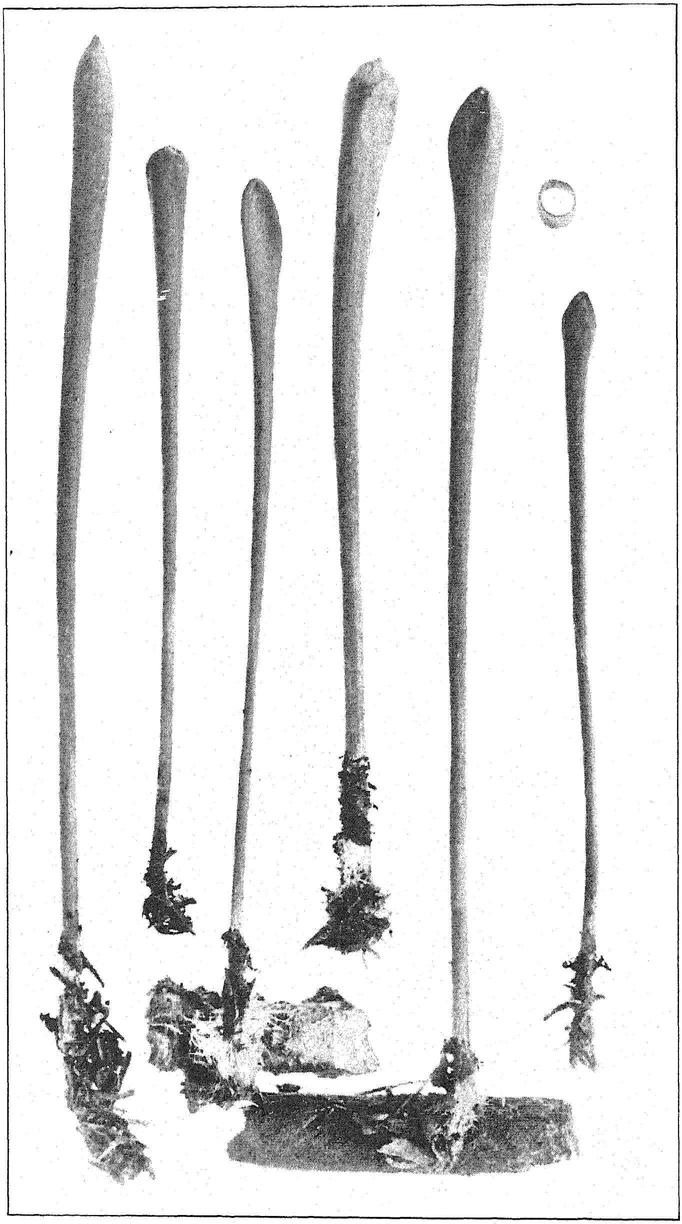


CLAVARIA ARDENIA Sow.

MYCOLOGIA

VOL. X MARCH, 1918 NO. 2

THE CLAVARIA FISTULOSA GROUP

EDWARD T. HARPER

(WITH PLATES 3–5, CONTAINING 8 FIGURES)

Plants of this group have been reported very rarely from this country. *Clavaria juncea* is listed by Dr. Peck in the 22d Report of the New York State Museum from specimens collected by Dr. Howe, and Peck says this was the first report of the species from America. It has been recently reported from Michigan by Kauffman. Clement's illustration in Minnesota Plant Studies, IV: p. 113, evidently refers to a form of the *Clavaria vermicularis* group.

Dr. Peck found a single specimen of *Clavaria fistulosa* in the Catskill Mountains in October, 1872, and this is the only collection of the species outside of Europe mentioned in the Sylloge. Professor Dearness collected the species in coniferous swamps at Avon, Canada, in October, 1897, and it was distributed in Fungi Columb. *1214* under the name *Clavaria inaequalis*. Professor Dearness has sent me specimens of the collection correctly named.

Clavaria contorta, which is supposed to be a young stage of *Clavaria fistulosa,* is said in the Sylloge to have been collected by some of the older botanists in New England and North Carolina.

The little notice the plants have received is probably due as much to the conditions under which sporophores are produced as to the rarity of the mycelium. It requires at least two weeks of daily rain, with the dead leaves on the ground continuously soaked with water, to produce a crop of *Clavaria juncea* at Neebish, Michigan. Under such conditions, specimens are usually to

[MYCOLOGIA for January (10: 1–52) was issued February 14, 1918.]

be found on the leaves in the woods and sometimes they are very abundant. *Clavaria fistulosa* is more rare. Only once have I seen it abundant at Neebish. I also found a single specimen near Lake Rosseau, in Ontario.

I show in the plates the following forms belonging to the group.

CLAVARIA ARDENIA Sow. Pl. 3

This form is more abundant than *Clavaria fistulosa* at Neebish. The clubs are enlarged and inflated at the apex. They are abruptly pointed when young but become truncate and often perforated when old. The plants are figured by Sowerby in his plate 215. The species is said to grow 8 inches high in the British Isles. Our plants were 4–7 inches high and about one fourth of an inch thick at the apex. Stevenson says it is the only form of *Clavaria fistulosa* found in the British Isles. His description reads: "Ferruginous, then date-brown, simple, very long, more than 20 cm., thickened upward, acute when young, then obtuse or hollowed out at the apex, tomentose at the base, not rooting, on fallen branches." The spores are given in the Sylloge as broad, hyaline, ovoid, apiculate at one end, $15 \times 8–9\,\mu$. The description fits our plants exactly but the spores were narrower, $12–16 \times 5–7\,\mu$. The plants grew on the ground in coniferous woods and the clubs were attached to small sticks by copious whitish mycelium as shown in the illustration. The species is usually considered a variety of *Clavaria fistulosa*.

CLAVARIA FISTULOSA Fries. Pl. 4, A

The photograph was taken from the Lake Rosseau specimen. It is not enlarged or inflated at the apex. It is the form illustrated by Britzelmayr. It appears to be typical *Clavaria fistulosa* and is described, as follows: "Simple, slender, very long, strict, fistulose, somewhat obtuse, yellow becoming reddish, root short, villous, spores ellipsoid-oblong, commonly obtuse above and attenuate at the base, hyaline, $14–16 \times 6–7\,\mu$." It is said to be very closely akin to *Clavaria macrorrhiza* and was considered by Fries to be a large form of *Clavaria juncea*.

CLAVARIA MACRORRHIZA Sw. Pl. 4, B

One of the plants sent me by Professor Dearness had a long rooting base. It is shown in the photograph. The top of the club was broken off, but Professor Dearness informs me it was about five inches long when collected. The plant appears to represent *Clavaria macrorrhiza,* which is described as "simple, fistulose, glabrous, subequal or somewhat thickened upward, obtuse, yellowish becoming fuscous, twisted below, rooted with a long whitish-fibrillose root." The root is said to be over three inches long and the club is 2–4 inches high. Swartz's illustration in Vet. Akad. Handl. *pl. 6, f. 1,* shows the long root perpendicular as if it grew straight down into the ground. The whole root is covered with long, white, villous hairs like those on the bases of the plants in our photographs of *Clavaria ardenia,* which seems to show that it grew attached to sticks or logs in leaf-cold. The hairs have collapsed in the dried plant from which the photograph was taken and do not show very plainly in the picture. Von Hoehnel in the Oesterr. Bot. Zeitschrift for December, 1904, argues that *Clavaria macrorrhiza* is a form of *Clavaria fistulosa* with a long root, and compares the roots of *Collybia esculenta* and *Collybia conigena,* which are long or short according to circumstances. He had not, however, found a plant with such a root.

CLAVARIA CONTORTA Holmsk. Pl. 4, C

I collected the specimens from which the photographs were taken on branches of dead alder at Neebish, Michigan, in October, 1911, and identified them as *Clavaria contorta.* The figures are reproduced natural size. The plants were on branches of a fallen tree above ground and I did not connect them with *Clavaria fistulosa,* which I have always found on sticks buried in leaves in coniferous woods. Von Hoehnel in the article mentioned above holds that *Clavaria contorta* is a young stage of *Clavaria fistulosa* and since reading his arguments I am inclined to agree that at least they belong to the same group. The tall, straight plant is very much like *Clavaria fistulosa.* The club is hollow with a very thin wall just like the section of *Clavaria ardenia* shown in the frontispiece. The substance of both is com-

posed of narrow, straight hyphae with large lactiferous tubes, and the spores are the same. In these small plants they average larger than in *Clavaria fistulosa,* $14–18 \times 6–9\,\mu$. The color of both species is the same. The young plants are stuffed and directly erumpent from the wood. Von Hoehnel found such forms as these growing with specimens of true *Clavaria fistulosa.* The usual description of *Clavaria contorta* reads: "Plants simple, erumpent, stuffed, spongy-fleshy, soft to the touch, somewhat twisted, rugose, obtuse, pruinose, watery-yellow. On dead branches of alder, hazel, etc. 2.5–3 cm. high, 6–9 mm. thick."

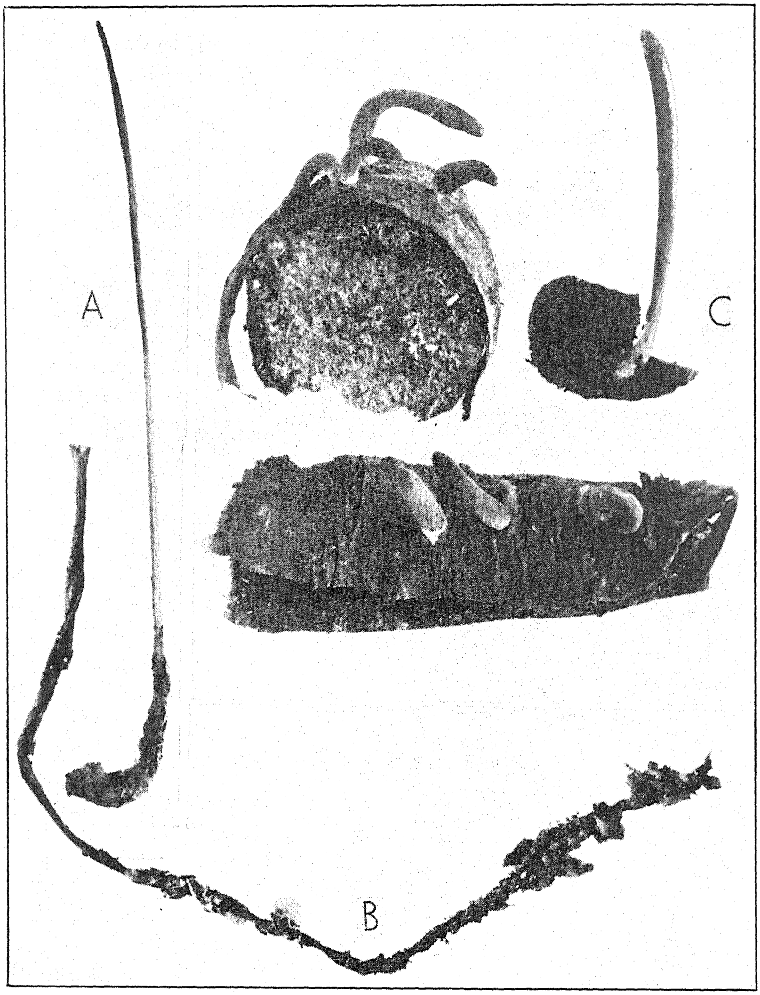
Von Hoehnel thinks that *Clavaria brachiata* Fries is also a form of *Clavaria fistulosa,* with the clubs branching.

CLAVARIA JUNCEA Fries. Pl. 5

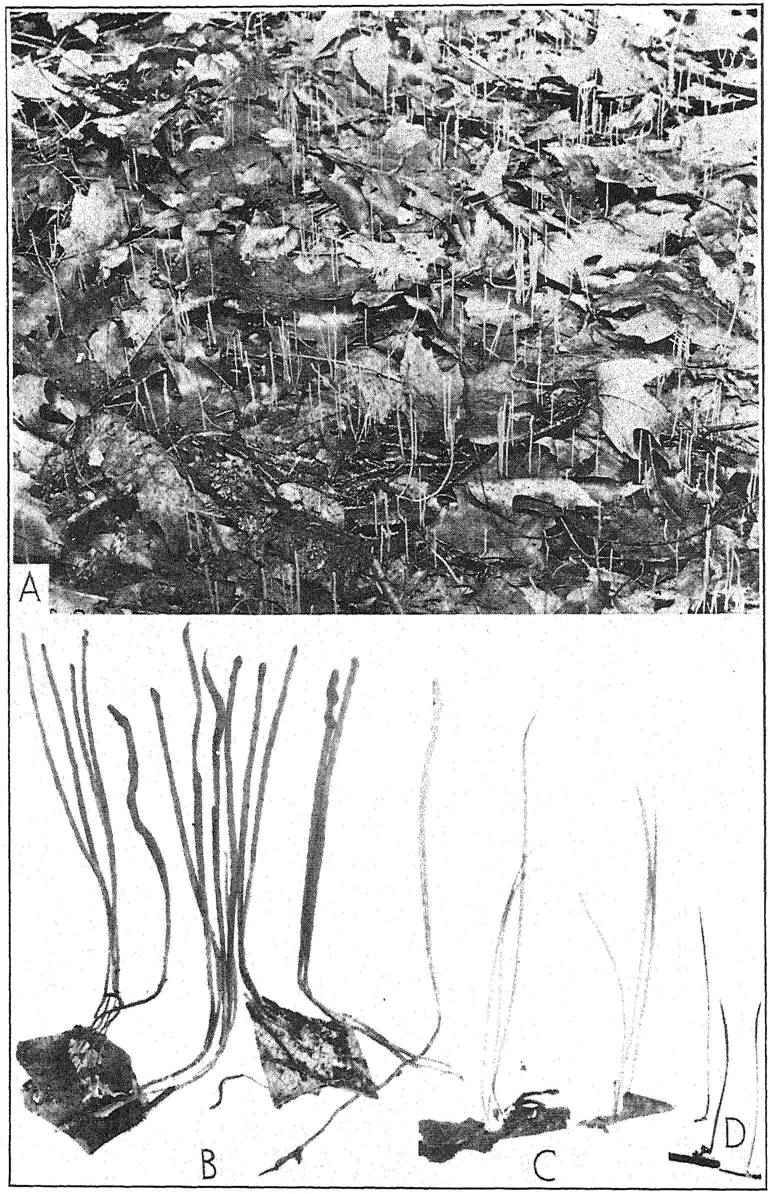
The plants grow on dead leaves of frondose trees and the decumbent, creeping base is attached to the leaf by white, villous mycelium. The mycelium appears to live in the mould and grows up over the leaves to form the fruiting clubs. The erect club is about 2 inches high, slender and straight, either obtuse at the apex as in *B* or acute as in *C*. Under favorable weather conditions the plants are very numerous and cover the leaves over wide spaces as shown in *A*. On one occasion there was a thick forest of these slender clubs on both sides of a path in the woods covering the leaves for a distance of twenty-five feet. The description of the species reads: "Gregarious, thin, filiform, flaccid, fistulose, acute, from pallid to rufescent, base creeping, fibrillose." According to Winter, the spores are obovoid, $4\,\mu$ in diameter. Schroeter gives the measurements as $8–9 \times 4–5\,\mu$. In our plants, the spores are $9–12 \times 4–5\,\mu$ and shaped like those in the other species in the group.

Clavaria juncea is the most common species in the group and has been illustrated seven times, according to Saccardo in the nineteenth volume of his "Sylloge." It is also reported from Ceylon and Australia.

Var. *vivipara* is a form reported in Europe and figured by Bulliard in his plate 463 and also by Britzelmayr. It has the club as well as the rooting base fibrillose on the sides. In all the Neebish plants the erect portion of the club was smooth.



A. CLAVARIA FISTULOSA FRIES
B. CLAVARIA MACRORRHIZA SW.
C. CLAVARIA CONTORTA HOLMSK



CLAVARIA JUNCEA Fries

In localities where the plants were not abundant, smaller forms like those in *D* were found with the others. They were sometimes attached to balsam needles. They appeared to be the same species, however. They resemble species of *Typhula,* but there is no sclerotoid tuber at the base.

Clavaria juncea is quite distinct from other members of the group, but it has the same essential features; hollow, thin-walled clubs composed of straight, parallel hyphae 6–8 μ in diameter, with many cross partitions. The plants are tough and elastic and it is difficult to keep them from curling long enough to make a photograph. They remain fresh but a short time and when dry are not easy to find.

The forms or species in this group are well characterized and quite distinct from other club-fungi. The external resemblance is perhaps nearest to some species of *Typhula* or species of *Clavaria* with caespitose clubs.

The real phylogenetic connection of the members of the group with each other is unknown and the superficial resemblances may be misleading. All the forms should be described, but kept together in a single group.

GENESEO, ILL.

EXPLANATION OF PLATES 3–5

Plate 3. *Clavaria ardenia* Sow.
Plate 4. *A. Clavaria fistulosa* Fries. $\times \frac{2}{3}$.
B. Clavaria macrorrhiza Sw.
C. Clavaria contorta Holmsk.
Plate 5. *A, B, C, D, Clavaria juncea* Fries.

THE DISTRIBUTION OF FUNGI IN PORTO RICO

Bruce Fink

What follows is based on a sojourn of two months in Porto Rico, in November and December, 1915, and January, 1916. The fungous flora was examined in several areas, selected to give a good knowledge of the fungi of the island as a whole. The collecting stations were about San Juan, Rio Piedras, Rio Grande, Mameyes, Vega Baja, Manati, Mayagüez, Yauco, Aibonito, and Naranjito. These areas were selected to give a view of the island from end to end and from side to side, and as much variety as possible with respect to elevation and rainfall. All elevations were reached from sea level to the highest on the island, 4,985 feet. All conditions with respect to precipitation of moisture were reached, from the desert conditions on the south side of the island with 15 to 30 inches per annum to 125 to 150 inches about El Yunque.

Each day's collecting occupied long hours and often long tramps, stopping neither for heat nor rain. The hand lens was used freely in the field, and no specimens were taken that did not seem to be in condition for determination. This method gave somewhat more than 2,200 numbers. Had specimens been taken without examination, probably two or three times as many could have been secured. Yet it is doubtful whether the larger amount of work required to study such a collection would add sufficiently to the results to warrant the method.

The prime purpose of the itinerary was to collect the ascomycetes. After these the agarics and the pore fungi received most attention. Among the ascomycetes, the Graphidaceae and the Arthoniaceae received first attention. The rusts and the imperfect fungi which grow on living plants had been collected by F. L. Stevens and others, and these, with the smuts, were passed over. All other fungi were taken as seen; but those outside the

groups to which special attention was directed were not, of course, secured in large numbers. The ascomycetes were very abundant, and areas a few rods square, which at first looked most unpromising, often held the collector for hours, taking the fungi from bark, leaves, rocks, pebbles, and soil.

Regarding the fungous flora in general, the rusts, the imperfect fungi, the black Perisporiaceae, the crustose lichens, the pyrenomycetes, and the Hysteriaceae abound. Foliose and fruticose lichens are frequent but scarcely common. Fleshy discomycetes were seen infrequently; but these are difficult to detect, unless one is giving sole attention to them. Agarics are by no means common. Pore fungi were seen more often; but these are scarcely frequent, excepting a few species. Mycelia of the Erysibaceae were seen occasionally, but diligent search failed to reveal any evidence of fruiting. The crustose, often inconspicuous Graphidaceae are the most common fungi; and the even more obscure Arthoniaceae are perhaps next in abundance, though so inconspicuous as to be seen infrequently, except by one well acquainted with the group.

A question about which little seems to be known is whether lichens occur commonly on rocks in the tropics. The rocks were found to bear quite as abundant and perhaps as varied an assemblage of lichens as do similar rocks in temperate regions. At lower elevations the flora of the rocks was peculiar and doubtless tropical, but from 2,000 to 5,000 feet the general appearance of the lichens was about the same as that commonly seen in temperate regions. It is not easy to secure lichens growing on rocks, especially in hot climates; and the failure to get more lichens from tropical rocks evidently does not signify that the plants are absent from such substrata.

Perhaps the thing that would impress the average mycologist most is the absence of the white Ersibaceae in fruit and the great abundance of the black Perisporiaceae in fruited condition. One accustomed to collecting in temperate regions will instinctively examine each white mycelium, expectant of that which seldom if ever results, the finding of perithecia. The white mycelia are rare and are seldom if ever fruited, while the black ones are abundant and are well fruited, except in the desert regions.

To those not acquainted with the tropics, it will probably be a little difficult to realize that the larger basidiomycetes are not abundant or even common. The short-lived agarics are seen but infrequently, and then as isolated specimens, or at best in small numbers. One may see as many in an hour in certain good areas in the mountains of Virginia or Kentucky as he would find in a month in Porto Rico. When seen here, the plants are usually in some well-protected spot, and solitary or so few in number that it is difficult or impossible to get a satisfactory herbarium specimen. Probably great tropical heat is the factor that accounts mainly for the infrequent occurrence of these plants. But the development of the sporophores in many areas of the moist and uniformly heated tropics is probably spread about equally throughout the year, and this would account for the infrequent occurrence of the sporophores at any particular time. Studies of conditions in tropical areas which have wet seasons alternating with dry ones would be interesting in this respect. Such an area was reached about Mayagüez, but the region was, unfortunately, examined during the dry season. The tougher, more durable pore fungi are seen more frequently, but these are by no means common.

The region about Yauco was extremely interesting with respect to the distribution of fungi. In the city and in the flat country to the south, one is in a desert with a rainfall of probably 20 to 30 inches per annum, while in the mountains four or five miles to the north there is abundant rain. In the one area agriculture is possible only through irrigation. In the other, rainfall is abundantly sufficient for agricultural purposes. Day after day rain fell in the mountains a few miles north of Yauco, while in Yauco and to the south the weather was dry. The mycologist is of course interested to know how the fungous flora is affected. Agarics and pore fungi were almost entirely absent south of Yauco, but were seen as often five miles to the north as in other parts of the island. The black Perisporiaceae were entirely absent from the desert, while they were abundant on leaves north of Yauco. To the uninitiated, the lichen flora of this desert would appear most uninviting, for scarcely a foliose or a fruticose

specimen was seen. However, rocks, bark, and wood were plastered over with crustose, usually inconspicuous forms. Indeed, the largest collection of fungi secured in a single day was 105 specimens obtained the first day in the desert south of Yauco. This collection will prove of special value for the large number of Graphidaceae and Arthoniaceae taken. No fleshy discomycetes were seen in the desert. No fungi were seen on the leaves, except possibly an occasional rust or an imperfect fungus, though fungi of various kinds abound on leaves in other parts of the island. No myxomycetes were seen south of Yauco, while these plants are common north of the city. The change in fungous flora in passing one mile or at most two miles northward from Yauco is most astonishing. The remarkable accompanying change in seed-plant flora is quite as interesting, but this lies outside the limits of this paper.

The collection has not been studied sufficiently to permit a more detailed statement regarding distribution; but the general account given above will, it is hoped, prove interesting and valuable. The great interest and value that would result from floristic and ecologic studies of the fungous flora of the island as a whole, and extending over many years, were distinctly realized during my short sojourn there. Much of great interest and value to the botanist and to the agriculturist and the horticulturist as well would result from such a detailed study of the fungous flora of Porto Rico.

MIAMI UNIVERSITY, OXFORD, OHIO.

THE AGARICACEAE OF TROPICAL NORTH AMERICA—VIII

William A. Murrill

In *Mycologia* for January, 1918, the first six genera in the subtribe Agaricanae were discussed; the remaining eight having been reserved for the present paper, which concludes the series. For a key to the genera of this subtribe, see *Mycologia* **10**: 15. 1918.

The total number of tropical agarics treated by me in this series of articles and in *North American Flora*, exclusive of doubtful species, amounts to 525, of which number 300 are newly described. A great many species would doubtless be added by further exploration, which is very much needed.

7. Drosophila Quél. Ench. Fung. 115. 1886

Lachrymaria Pat. Hymén. Eur. 122. 1887.
Cortinopsis Schroet. Krypt.-Fl. Schles. 3^1: 566. 1889.
Glyptosperma Fayod, Ann. Sci. Nat. VII. **9**: 377. 1889.
Gymnochilus Clements, Bot. Surv. Neb. **4**: 23. 1896.
Hypholomopsis Earle, Bull. N. Y. Bot. Gard. **5**: 436. 1909.

This genus, well represented by the common species, *D. appendiculata*, is distinguished from other brown-spored genera by an appendiculate veil, fleshy stipe, adnate or adnexed lamellae, and a pileus usually thin, fragile, and solitary or subcespitose. The number of temperate species is large and their characters rather indistinct. Several cespitose species occur in tropical America.

Species occurring on cultivated or exposed soil.
  Hymenophores solitary.
    Stipe 2 mm. thick .... 1. *D. castaneidisca.*
    Stipe 7 mm. thick .... 2. *D. brevipes.*

Hymenophores gregarious, rarely cespitose.
Pileus grayish-brown, argillaceous when dry.. 3. *D. campestris.*
Pileus dark-brown or reddish-brown, paler when dry ....
Spores very pale, 11–13 μ long .... 4. *D. pallidispora.*
Spores darker and shorter .... 5. *D. flocculosa.*
Species occurring among humus in woods.
Hymenophores solitary.
Pileus umbonate .... 6. *D. tepeitensis.*
Pileus not umbonate .... 7. *D. jalapensis.*
Hymenophores subcespitose .... 8. *D. tenuis.*
Species occurring on dead wood either buried or exposed.
Hymenophores solitary or gregarious.
Spores truncate .... 9. *D. truncatispora.*
Spores not truncate .... 10. *D. atricastanea.*
Hymenophores densely cespitose.
Stipe 5–7 cm. long; margin of pileus not striate. 11. *D. appendiculata.*
Stipe 6–12 cm. long; margin of pileus faintly striate .... 12. *D. caespitosa.*

1. **Drosophila castaneidisca** sp. nov.

Pileus thin, convex, solitary, 2.5 cm. broad; surface hygrophanous, avellaneous, slightly tinged with chestnut, pale-chestnut on the disk; margin straight, entire, concolorous, striate; lamellae adnate, narrow, crowded, chestnut; spores ellipsoid or ovoid, smooth, pale-bay under the microscope, $7 \times 3.5–4.5\,\mu$; stipe cylindric, equal, smooth, white, furfuraceous, 3 cm. long, 2 mm. thick.

Type collected in soil on a rubbish heap in Castleton Gardens, Jamaica, 180 m. elevation, December 14, 15, 1908, *W. A. & Edna L. Murrill 117.* Known only from the type locality.

2. **Drosophila brevipes** sp. nov.

Pileus broad, thin, fleshy, irregularly convex, obtuse, not fully expanding, solitary, 4–5 cm. broad; surface dry, corrugate and plicate, pale-tan, darker on the disk, delicately floccose from the remains of the veil, substriate on the margin, which becomes upturned on drying; context without odor; lamellae adnate, crowded, rather narrow, uneven and many times inserted, pallid to brown; spores ellipsoid, smooth, opaque, distinctly purplish-brown under the microscope, uniguttulate, about $9 \times 4.5\,\mu$; cystidia few, delicate, hyaline, subcylindric, about $50 \times 12\,\mu$; stipe tapering downward, whitish, minutely whitish-flocculose above, fibrillose-

lacerate below, hollow, 5 cm. long, 7 mm. thick; veil white, evanescent.

Type collected in red soil in the Botanic Garden at Santiago de las Vegas, Cuba, January 11, 1906, *F. S. Earle 500.* Known only from the type locality. Professor Earle's very complete notes are accompanied by two excellent photographs. The species has somewhat the appearance of *D. appendiculata* and also has cystidia.

3. **Drosophila campestris** (Earle)

Gymnochilus campestris Earle, Inf. An. Estac. Centr. Agron. Cuba **1**: 238. 1906.

Hypholoma campestre Morg. Jour. Myc. **14**: 30. 1908.

Described from specimens collected by Earle on Bermuda grass lawns at Santiago de las Vegas, Cuba.

Cuba, *Earle 363.*

4. **Drosophila pallidispora** sp. nov.

Pileus thin, irregular, companulate, at length spreading at the margin, gregarious, 3 cm. broad; surface hygrophanous, silky, very faintly striate, at first chestnut, fading to pale-tan, pallid when dry; context thin, with mild, slightly mawkish taste; lamellae adnexed, broad, crowded, pale-argillaceous, at length brown; spores oblong-ellipsoid, smooth, almost hyaline under the microscope but with a pale-umbrinous tint, $11–13 \times 4.5–5.5\,\mu$; stipe slightly tapering upward, fibrillose, white, hollow, 5–6 cm. long, 3–5 mm. thick; veil scarcely appendiculate but forming deciduous flocs on the young pileus.

Type collected in soil in a garden at Herradura, Cuba, August 17, 1907, *F. S. Earle 572.* Known only from the type locality.

5. **Drosophila flocculosa** (Earle)

Gymnochilus flocculosus Earle, Inf. An. Estac. Centr. Agron. Cuba **1**: 238. 1906.

Hypholoma flocculosum Morg. Jour. Myc. **14**: 65. 1908.

Described from specimens collected by Earle on moist red earth under buildings at Santiago de las Vegas, Cuba.

Cuba, *Earle 136, 144.*

6. **Drosophila tepeitensis** sp. nov.

Pileus convex to nearly plane, with a low umbo, solitary, 2.5 cm. broad; surface glabrous, hygrophanous, radiate-rugose, dull-latericious, smooth and dark-brown on the umbo; margin undulate, dark-fuliginous; lamellae adnate, plane, rather distant, brown to black at maturity; spores elongate-ellipsoid, smooth, opaque, castaneous-fuliginous under the microscope, $12–13 \times 7\ \mu$; stipe tapering upward, smooth, nearly glabrous, hygrophanous, dull-white, hollow, 8 cm. long, 5 mm. thick near the base.

Type collected on the ground among rich humus in woods in the Tepeite Valley near Cuernavaca, Mexico, 2,100 m. elevation, December 28, 1909, *W. A. & Edna L. Murrill 483*. Another specimen collected in the same locality (*No. 467*) appears to be the same but has a stipe that is much longer and covered with dense tomentum at the much swollen base.

7. **Drosophila jalapensis** sp. nov.

Pileus convex to plane, thin, not umbonate, solitary, 4 cm. broad; surface glabrous, hygrophanous, striate, dull-avellaneous-isabelline, with isabelline disk; margin entire, concolorous; lamellae adnate, crowded, rather narrow, dark-purplish-brown at maturity; spores oblong-ellipsoid, smooth, not abruptly contracted at the ends, opaque, bay under the microscope, $9 \times 4.5\ \mu$; stipe long and slender, equal or slightly tapering upward, smooth, glabrous, white, fragile, hollow, 14 cm. long, 4 mm. thick.

Type collected on the ground among humus in woods at Jalapa, Mexico, 1,500 m. elevation, December 12–20, 1909, *W. A. & Edna L. Murrill 170*. Known only from the type locality.

8. **Drosophila tenuis** sp. nov.

Pileus very thin and fragile, convex, subcespitose, 3–4 cm. broad; surface hygrophanous, subglabrous, brownish, paler when dry, faintly striate; context very thin and watery; lamellae adnexed or adnate, subcrowded, rather broad, reddish-brown at maturity; spores ellipsoid, smooth, decidedly purplish-brown under the microscope, $7–8 \times 4–5\ \mu$; stipe cylindric, glabrous, shining, white, fragile, hollow, 7–8 cm. long, 3 mm. thick; veil not evident when collected.

Type collected on the ground in woods at the base of El

Yunque Mountain, Cuba, March, 1903, *L. M. Underwood & F. S. Earle 415*. Known only from the type locality.

9. **Drosophila truncatispora** sp. nov.

Pileus becoming slightly convex, not quite fully expanding, regular in shape, not umbonate, solitary or gregarious, 2.5 cm. broad; surface hygrophanous, avellaneous, with pale-isabelline-fulvous, imbricate, floccose scales, which are not very conspicuous but are nevertheless distinct; margin entire, concolorous; lamellae adnexed, plane, broad, subdistant, avellaneous to pale-chestnut; spores ovoid with truncate ends, somewhat like a grain of corn in horizontal outline, smooth, purplish-brown under the microscope, 1–2-guttulate, $6–7 \times 4–5\,\mu$; stipe short, equal, smooth, white, fragile, hollow, 4 cm. long, 3 mm. thick.

Type collected on rotten wood or humus in a moist river valley at Xuchiles, near Cordoba, Mexico, 450 m. elevation, January 17, 1910, *W. A. & Edna L. Murrill 1144*. Also collected at the same time and in the same locality, *W. A. & Edna L. Murrill 1128*.

10. **Drosophila atricastanea** sp. nov.

Pileus subfleshy, soft, delicate, broadly campanulate to subexpanded, gregarious, 2–3 cm. broad; surface strongly hygrophanous, glabrous, dark-chestnut, becoming pallid when dry except on the disk; margin concolorous, not striate; lamellae adnate, crowded, rather broad, concolorous; spores broadly ellipsoid or ovoid, smooth, rounded at both ends, very pale purplish-brown with a yellowish tint under the microscope, subtransparent, $6–8 \times 4–5\,\mu$; stipe subcylindric, white, minutely floccose, hollow, 4–5 cm. long, 2–4 mm. thick; veil said to be wanting, even in young stages.

Type collected on buried wood in a banana field at Santiago de las Vegas, Cuba, June 17, 1904, *F. S. Earle 83*. Known only from the type locality. This species is peculiar in having no veil, and the spores are pale and very broad, although not truncate.

11. DROSOPHILA APPENDICULATA (Bull.) Quél. Ench. Fung. 116. 1886

This is a very common edible species, widely distributed in temperate regions. Patouillard reports it common in Guadeloupe.

I have found it rather scarce in tropical regions during the winter but it may be more abundant there during the rainy season.

Cuba, *F. S. Earle 289;* Santo Domingo, *J. R. Johnston 803;* Jamaica, at low elevations, *W. A. Murrill 230, 825;* Colima, Mexico, *W. A. Murrill 612, 617.*

12. **Drosophila caespitosa** (Earle)

Gymnochilus caespitosus Earle, Inf. An. Estac. Centr. Agron. Cuba **1**: 240. 1906.

Hypholoma caespitosum Morg. Jour. Myc. **14**: 29. 1908.

Known only from specimens collected by Earle at the base of a stump in a garden at Santiago de las Vegas, Cuba.

8. HYPHOLOMA (Fries) Quél. Champ. Jura Vosg. 112. 1872

Agaricus § *Hypholoma* Fries, Syst. Myc. **1**: 287. 1821.

Naematoloma P. Karst. Bidr. Finl. Nat. Folk **32**: 495. 1879.

This genus differs from *Drosophila* in having a dry, glabrous, firm, densely cespitose hymenophore. It contains few species, but they are abundant in temperate regions and have been much confused among themselves.

Pileus acutely umbonate .... 1. *H. papillatum.*
Pileus not acutely umbonate.
  Pileus yellow or reddish .... 2. *H. fasciculare.*
  Pileus some shade of green, at least when young.
    Lamellae white; stipe 5–10 cm. long .... 3. *H. tuberculatum.*
    Lamellae green; stipe 3–4 cm. long .... 4. *H. flavovirens.*

1. HYPHOLOMA PAPILLATUM Pat. Bull. Soc. Myc. Fr. **14**: 54. 1898

Described from specimens collected by Paul Maury on decaying logs in Mexico. Known only from the type locality.

2. HYPHOLOMA FASCICULARE (Huds.) Quél. Champ. Jura Vosg. 113. 1872

This very common temperate species has been frequently reported from tropical North America by Patouillard and others,

and one would expect it to occur there at high elevations. There are, however, certain tropical species with which it might be confused by the superficial observer.

3. HYPHOLOMA TUBERCULATUM Pat. Bull. Soc. Myc. Fr. **15**: 196. 1899

Described from specimens collected by Duss at Basse-Terre, Guadeloupe, on old trunks of *Hura crepitans*. Known only from the type locality. Morgan transferred this species to *Stropharia* because of its persistent annulus, while Patouillard placed it in *Hypholoma* probably because of its close relationship to *H. fasciculare.*

4. **Hypholoma flavovirens** sp. nov.

Pileus convex, not umbonate, densely cespitose, 2–3 cm. broad and about 5 mm. high; surface dry, glabrous, faintly rugose, pale-flavovirens; lamellate adnate, arcuate, narrow, crowded, flavovirens, becoming pale-purplish-brown at maturity; spores ellipsoid or elongate-ovoid, smooth, usually 2-guttulate, very pale purplish-brown under the microscope, $7 \times 4\,\mu$; stipe equal, smooth, glabrous, pale-flavovirens, slightly ochraceous below, 3–4 cm. long, 2–2.5 mm. thick; veil slight, appendiculate, evanescent.

Type collected on decayed logs and stumps at Cinchona, Jamaica, 1,500 m. elevation, December 25, 1908, *W. A. & Edna L. Murrill 553*. Also collected at Cinchona, Jamaica, *W. A. & Edna L. Murrill 534;* on a log on Sir John Peak, Jamaica, *W. A. Murrill 782;* on a rotten stump at Mooretown, Jamaica, *F. S. Earle 559;* and on a stump at Jalapa, Mexico, *W. A. & Edna L. Murrill 72, 74.* This species occurs in abundance at Cinchona on dead logs and stumps in the vicinity of the laboratory. It closely resembles *Psilocybe subviridis* and also suggests *Hypholoma fasciculare.*

9. PILOSACE (Fries) Pat. Hymén. Eur. 122. 1887

Agaricus § *Pilosace* Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 25. 1851.

This genus has a fleshy stipe and purplish-brown spores, but differs from *Agaricus* in being without a veil. There are very

few species. The two given below from tropical America are taken from the studies of Fries based on unusually poor colored drawings by Oersted. I have been unable to find any specimens. It is just possible that Oersted's specimens really belonged to *Agaricus* and that the veil had been lost.

Pileus 5 cm. broad, white with white scales .... 1. *P. hololepis.*
Pileus 10 cm. broad, white with black scales .... 2. *P. tricholepis.*

1. PILOSACE HOLOLEPIS (Fries) Sacc. Syll. Fung. **5**: 1011. 1887

Agaricus hololepis Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 25. 1851.

Known only from specimens collected on the ground in Costa Rica by Oersted.

2. PILOSACE TRICHOLEPIS (Fries) Sacc. Syll. Fung. **5**: 1010. 1887

Agaricus tricholepis Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 25. 1851.

Described from specimens said by Fries to have been collected on manured ground in the island of St. Thomas. Oersted's drawing bears the name St. Croix. This species is very much like *Agaricus,* but "without a trace of a veil."

10. GOMPHIDIUS Fries, Gen. Hymen. 8. 1836

This genus is distinguished by its glutinous veil; decurrent, waxy lamellae; and black, elongate spores. There are very few species and these occur mostly in temperate regions. The single tropical species is known only from Cinchona, Jamaica, at an altitude of 1,500 meters.

1. **Gomphidius jamaicensis** sp. nov.

Pileus convex, slightly umbonate, 3–5 cm. broad; surface dark-brown, blackening on drying, decorated with imbricate, glutinous scales, not striate on the margin; context mild to the taste, yellowish, slowly changing to brownish; lamellae decurrent, arcuate, broad, subdistant, dull-pinkish-yellow to gray, blackening on dry-

ing; spores fusiform, smooth, black, $16–18 \times 5–6\,\mu$; cystidia clavate, opaque at the ends, abundant, $125\,\mu$ long; stipe tapering downward, concolorous, solid, blackening at the apex on drying, decorated with reddish-brown fibrils, 4–8 cm. long, 4–8 mm. thick; veil forming an evanescent annulus.

Type collected on the ground at Cinchona, Jamaica, 1,500 m. elevation, November 1, 1902, *F. S. Earle 352.* Known only from the type locality.

11. STROPHARIA (Fries) Quél. Champ. Jura Vosg. 110. 1872

Agaricus § *Stropharia* Fries, Monog. Hymen. Suec. **1**: 409. 1857.

Geophila Quél. Ench. Fung. 111. 1886.

This rather large genus is distinguished by a fleshy stipe, adnate or adnexed lamellae, and the presence of an annulus, which last is somewhat uncertain at times because of its evanescent character. Several of the species grow on manure or manured ground and are widely distributed. There is considerable tropical material of this genus in the herbarium of the New York Botanical Garden, some of it evidently representing new species, but most of it is poorly dried and without notes and it is impossible to work it in this shape. Such specimens are retained only in the hope that they may some day be matched up with more recent specimens that have been better studied and better preserved.

Pileus dry.
- Pileus solitary .... 1. *S. troyana.*
- Pileus cespitose.
  - Stipe 2–4 mm. thick .... 2. *S. floccosa.*
  - Stipe 5–10 mm. thick .... 3. *S. caespitosa.*

Pileus viscid, at least when young and moist.
- Lamellae entire; spores very large.
  - Stipe 3–5 mm. thick; pileus not umbonate ...... 4. *S. semiglobata.*
  - Stipe 5–10 mm. thick; pileus umbonate .... 5. *S. cubensis.*
- Lamellae serrate; spores $7 \times 5\,\mu$ .... 6. *S. bermudiensis.*

1. **Stropharia troyana** sp. nov.

Pileus convex to depressed, scattered, 4 cm. broad, about 1 cm. thick; surface dry, glabrous, smooth, isabelline, fulvous at the center, the cuticle cracking toward the margin; lamellae slightly

sinuate, close, of medium breadth, dull-white to umbrinous; spores oblong-ovoid, or ellipsoid, smooth, granular with several small nuclei, murinous-umbrinous under the microscope, not opaque, 7–9 × 4–4.5 μ; stipe thick, fleshy, cylindric, equal, hollow, cremeous, glabrous, striate above, smooth below, white at the base, 4 cm. long, 1 cm. thick; annulus large, persistent, sheathing, fixed below, white to discolored, serrate above from contact with the lamellae, attached a little above the center of the stipe.

Type collected on partly shaded soil in a yam patch in Troy and Tyre, Jamaica, January 12–14, 1909, *W. A. Murrill & W. Harris 953*. This attractive species much resembles *Pholiota*, but its spore characters place it in *Stropharia*. It was found but once. Colored drawings of young and mature stages were made by Mrs. Murrill.

2. STROPHARIA FLOCCOSA Earle, Inf. An. Estac. Centr. Agron. Cuba 1: 241. 1906

Described from several collections in the vicinity of Santiago de las Vegas, Cuba. It occurs on the ground and is usually clustered, having the appearance of *Hypholoma*. It has not been collected elsewhere.

3. **Stropharia caespitosa** sp. nov.

Pileus fleshy, rather thin, campanulate to convex, cespitose, 3–5 cm. broad; surface dry, pallid with brownish shades, floccose-scaly, at length glabrous, rugose; margin thin, fluted, scarcely striate; context white with mild, pleasant flavor; lamellae adnexed, crowded, rather narrow, white to pale-purplish-brown; spores generally smooth, ellipsoid, rounded at both ends, decidedly purplish-brown under the microscope, 6–7 × 3.5–4 μ, but also quite often oblong-ellipsoid or oblong-ovoid, uniguttulate, 10–12 × 5 μ; stipe subcylindric, tapering below, white, densely floccose, hollow, 7–10 cm. long, 5–10 mm. thick; veil white, thick, usually forming a more or less deciduous annulus about 3 cm. from the apex of the stipe.

Type collected by Van Herman in red clay soil under a house at Santiago de las Vegas, Cuba, September 16, 1904, *F. S. Earle 204*. Known only from the type locality. This species resembles the annulate form of *Drosophila appendiculata*.

4. STROPHARIA SEMIGLOBATA (Batsch) Quél. Champ. Jura Vosg. 112. 1872

A widely distributed species, occurring on manure or manured ground. Patouillard reports it from Costa Rica and it probably occurs elsewhere in tropical America at high altitudes, but I have at hand very few collections from that region. At Cinchona, Jamaica, 5,000 feet elevation, I found the common, slender-stemmed form twice on horse manure (Nos. *561* and *638*). The spores were ellipsoid, smooth, opaque, umbrinous under the microscope, reaching $18 \times 12\,\mu$.

At the same place and on the same substratum, I found a larger form with thicker stipe and more slender spores (No. *449*), which may be briefly described, as follows: pileus hemispheric to top-shaped, solitary, 3.5 cm. broad, 2 cm. thick; surface smooth, viscid, shining, nearly melleous; lamellae stramineous, soon colored by the spores, which are oblong-ellipsoid, smooth, opaque, of enormous size, umbrinous, $21 \times 9\,\mu$; stipe cylindric, equal, smooth, viscid, shining, nearly melleous, 5 cm. long, 5 mm. thick; annulus glutinous, pale-yellowish.

5. STROPHARIA CUBENSIS Earle, Inf. An. Estac. Centr. Agron. Cuba **1**: 240. 1906

A large and handsome plant described from half a dozen collections in pastures and manured places about Santiago de las Vegas, Cuba. Earle remarks that it is the commonest Cuban species. Collected also in Porto Rico, *E. G. Britton & D. W. Marble 748* and *Bruce Fink 899, 1955;* and in British Honduras, *Morton E. Peck.*

6. **Stropharia bermudiensis** (Mass.)

Hypholoma bermudiense Mass. Kew Bull. Misc. Inf. **1899**: 184. 1899.

Described from specimens collected on the ground at St. George's, Bermuda, by Cummins and said to be allied to *Stropharia aeruginosa* but distinguished by its thin pileus and coarsely serrate gills. The pileus is smooth, pale-ochraceous, aeruginous

toward the margin, viscid, 3–4 cm. broad; spores $7 \times 5\ \mu$; stipe whitish, glabrous above the annulus, squamulose below, 3–4 cm. long.

DOUBTFUL SPECIES

Stropharia melasperma (Bull.) P. Karst. Bidr. Finl. Nat. Folk 32: 489. 1879. Reported from Costa Rica by Patouillard.

Stropharia stercoraria (Fries) Quél. Champ. Jura Vosg. 111. 1872. Probably confused with *S. semiglobata* in tropical America, as it is elsewhere.

12. AGARICUS L. Sp. Pl. 1171. 1753

Pratella S. F. Gray, Nat. Arr. Brit. Pl. 1: 626. 1821.
Psalliota Quél. Champ. Jura Vosg. 107. 1872.

This genus, distinguished among brown-spored gill-fungi by a fleshy stipe, free lamellae, and the presence of an annulus, has received much attention from mycologists because of the important edible species in it. The different species are usually not very well characterized, being much the same in shape and color and differing very little in spore characters. Moreover, the variations in some species are quite confusing. Judging from the wealth of material at hand, it would seem that the inhabitants of tropical America are fully as well provided with safe, appetizing food supplied by members of this genus as are their brothers farther north.

Species occurring on dead roots of bamboo .... 1. *A. bambusigenus.*
Species occurring among humus in woods or thickets.
  Pileus grayish with brown scales; stipe 4 mm. thick. 2. *A. angustifolius.*
  Pileus fawn-colored with reddish shades; stipe 8 mm. thick .... 3. *A. subsilvicola.*
  Pileus brownish, darker brown on the rounded umbo; stipe 5–7 thick .... 4. *A. Johnstonii.*
  Pileus purplish-incarnate or rose-colored.
    Pileus 5 cm. broad........................ 5. *A. cinchonensis.*
    Pileus 10 cm. broad .... 6. *A. Venus.*
Species occurring in grass on lawns or in fields.
  Pileus white, without squamules.
    Annulus simple. .... 7. *A. campester.*
    Annulus of two parts, radially split below .... 8. *A. pratensis.*
  Pileus white or yellowish, with brownish squamules.
    Pileus 5–10 cm. broad .... 7. *A. campester.*

Pileus 10–18 cm. broad.
Surface pure-white, with a few brownish scales .... 9. *A. subpratensis.*
Surface dirty-white or yellowish, with numerous scales .... 10. *A. praemagnus.*
Pileus reddish, umbrinous on the disk .... 11. *A. jejunus.*
Species occurring in cultivated or exposed soil, manure heaps, rubbish, etc.
Pileus 3–6 cm. broad.
Stipe 2.5 cm. long .... 12. *A. herradurensis.*
Stipe 4–6 cm. long.
Surface white .... 13. *A. Earlei.*
Surface pale-chestnut .... 14. *A. xuchilensis.*
Pileus 6–8 cm. broad, white with ochraceous disk .. 15. *A. ochraceidiscus.*
Pileus 10 cm. or more broad.
Surface decorated with small scales .... 16. *A. Hornei.*
Surface decorated with large scales.
Surface scaly at the center only; spores 11 × 8 μ .... 17. *A. guadelupensis.*
Surface scaly all over; spores 5 × 3.5 μ .. 18. *A. Shaferi.*

1. AGARICUS BAMBUSIGENUS Berk. & Curt. Jour. Linn. Soc. **10**: 291. 1868

Described from three collections by Wright in Cuba, where it was found growing in thick clusters on dead roots of bamboo. The pileus is convex to plane, umbonate, reddish, squamulose; stipe squamulose, white, 8 cm. long; spores ellipsoid, smooth, often obliquely papillate at the base, dark-purplish-brown, uniguttulate, mostly 4.5 × 2.5 μ, a few reaching 6 × 4 μ; annulus superior, ample. The type specimens at Kew resemble *A. Earlei,* but the surface is more imbricate-squamulose, with dark umbo, and the stipe twice as long.

2. **Agaricus angustifolius** sp. nov.

Pileus thin, convex to expanded, gregarious, 4–6 cm. broad; surface dry, grayish with brown scales, brown on the disk; margin entire, concolorous; context thin, whitish, with mild taste; lamellae free, much crowded, narrow, bright-pink to brown; spores ellipsoid, smooth, obliquely apiculate at the base, rather pale purplish-brown with a yellowish tint under the microscope, uniguttulate, 5–5.5 × 2.5–3 μ; stipe cylindric, glabrous, pallid, hollow, 6 cm. long, 4 mm. thick; annulus ample, attached very near the apex of the stipe.

Type collected on the ground in moist woods at Rose Hill, Jamaica, 1,200 m. elevation, October 30, 1902, *F. S. Earle 287*. Known only from the type locality. This is one of the slender species of the genus, with thin pileus, very narrow, crowded lamellae, and slender stipe. It is not related, however, to *Lepiota*.

3. **Agaricus subsilvicola** sp. nov.

Pileus thin, expanded, solitary, 8 cm. broad; surface subglabrous, moist or subviscid, smooth, not striate, fawn-colored or pallid with reddish shades, darker on the disk; margin entire, concolorous; context pallid with a reddish tint, the flavor peculiar, subaromatic and unpleasant; lamellae free, rather narrow, crowded, dark-pink to brown; spores ellipsoid, smooth, often indistinctly obliquely apiculate at the base, rather pale purplish-brown with a yellowish tint under the microscope, 1–2-guttulate, $5 \times 2.5–3\,\mu$; stipe cylindric, slightly enlarged at the base, brownish and silky above the annulus, whitish and fibrillose below, solid, firm, tough, 8–10 cm. long, 8 mm. thick; annulus ample, white, persistent, conspicuously floccose below, distant 1–2 cm. from the apex of the stipe.

Type collected at Cinchona, Jamaica, 1,500 m. elevation, November 2, 1902, *F. S. Earle 380*. Also collected on the ground in moist woods at Rose Hill, Jamaica, 1,200 m. elevation, October 30, 1902, *F. S. Earle 288*. This species resembles *Agaricus silvicola* in shape and size but differs somewhat in color, taste, etc., and the spores are considerably smaller.

4. **Agaricus Johnstonii** sp. nov.

Pileus thin, convex to expanded, umbonate, becoming somewhat depressed with age, solitary or gregarious, 5–7 cm. broad; surface dry, squamulose, brownish, darker brown on the rounded umbo, becoming bay-brown throughout on drying; margin entire, concolorous; lamellae free, crowded, somewhat ventricose, dull-chocolate-brown at maturity; spores ellipsoid, smooth, indistinctly obliquely papillate at the base, rather dark purplish-brown under the microscope, 1–2-guttulate, $4.5 \times 2.5\,\mu$; stipe subcylindric, slender, smooth, fibrous-stuffed, whitish, becoming brownish in old specimens, 7–9 cm. long, 5–7 mm. thick; annulus prominent, membranous, persistent, white, attached near the apex of the stipe.

Type collected in humus in woods at Rio Piedras, Porto Rico, June 11, 1914, *J. R. Johnston 1945*. Also collected in the same vicinity on humus in Deecmber, *J. R. Johnston 135, 3485*.

5. **Agaricus cinchonensis** sp. nov.

Pileus convex to nearly plane, somewhat umbonate, gregarious, 5 cm. broad, 1 cm. thick; surface purplish-incarnate, fibrillose, fulvous on the umbo; margin undulate, concolorous; lamellae free, crowded, ventricose, salmon-pink; spores ovoid or ellipsoid, smooth, distinctly obliquely papillate at the base, dark-purplish-brown, opaque, $4–5 \times 3.5\,\mu$; stipe subequal except at the enlarged base, nearly smooth, griseous, 5 cm. long, 8 mm. thick; annulus white, membranous, persistent, attached near the middle of the stipe.

Type collected on the ground in a thicket at the edge of a field at Cinchona, Jamaica, 1,500 m. elevation, December 25, January 8, 1908–9, *W. A. & Edna L. Murrill 444*. Known only from the type locality.

6. **Agaricus Venus** sp. nov.

Pileus convex to plane or slightly depressed, regular, rather thin, solitary, 10 cm. broad; surface mostly rose-colored, melleous in some places, imbricate-fibrillose, castaneous and rimose on the disk; margin straight, concolorous, not striate; lamellae free, crowded, ventricose, salmon-pink; spores oblong-ellipsoid, smooth, obliquely apiculate at the base, purplish-brown, opaque, $5–6 \times 3–3.5\,\mu$; stipe smooth and griseous above, white with chestnut blotches and scales below, conspicuously bulbous, 8 cm. long, 1.2–2.5 cm. thick; annulus large, membranous, simple, white, attached about the middle of the stipe.

Type collected on the ground under tree ferns at Morce's Gap, Jamaica, 1,500 m. elevation, December 29, 30, January 2, 1908–9, *W. A. & Edna L. Murrill 749½*. Known only from the type locality. This very beautiful species was discovered by Mrs. Murrill, who made a colored drawing of it.

7. AGARICUS CAMPESTER L. Sp. Pl. 1173. 1753

This common temperate species does not appear to be at home in the tropics, at least in its typical form in the wild state.

Patouillard reports it from Brazil and Guadeloupe and Léveillé from Mexico, while specimens from Santo Domingo were so labeled by Berkeley at Kew. Two collections were recently brought in from Bermuda, which is not altogether tropical territory, by *Brown, Britton & Seaver 1390, 1513*. Some of the numerous varieties of this species may well occur in heavily manured cultivated ground in tropical regions. A note made by me at Hope Gardens, Jamaica, January 9, 1909, reads, as follows: "*A. campester* on the lawns in Hope Gardens very abundant last week, according to Mr. Harris, but invariably small."

8. AGARICUS PRATENSIS Scop. Fl. Carn. ed. 2. 2: 419. 1772

Agaricus arvensis Schaeff. Fung. Bavar. 4: 73. *pl. 310, 311.* 1774.

The horse mushroom is abundant in temperate regions, where it is extensively collected for food. Patouillard has it in his herbarium from Oaxtepec, Mexico, collected by Paul Maury. There are at hand two recent collections from Bermuda by *Brown, Britton & Seaver 1347, 1512*. See *A. subpratensis*.

9. **Agaricus subpratensis** sp. nov.

Pileus globose to convex, very thick and fleshy, growing in large circles, reaching 10 cm. or more broad; surface dry, white, cottony, with scattered, brownish, imbricate scales; margin white, thick; lamellae free, crowded, rather narrow, pink to blackish-brown; spores broadly ovoid, smooth, conspicuously obliquely papillate at the base, with a very large nucleus, purplish-brown with a slightly yellowish tint under the microscope, $8 \times 5\ \mu$; stipe short, thick, tapering upward from a swollen base, white, fibrillose, solid, 5–8 cm. long, 2 cm. or more thick; annulus thick, membranous, white, persistent, attached near the apex of the stipe.

Type collected on the golf links at Constant Spring Hotel, Kingston, Jamaica, January 9–10, 1909, *W. A. Murrill 824*. Known only from the type locality. This species resembles *A. pratensis* both in appearance and habit but is conspicuously squamulose and has a shorter stipe.

10. **Agaricus praemagnus** sp. nov.

Pileus large, thick and fleshy, convex to expanded, gregarious to cespitose, 12–18 cm. broad; surface avellaneous to dirty-white or yellowish, with minute, appressed, avellaneous or brownish scales, the disk concolorous or very slightly darker; margin thin, not striate, pallid, exceeding the lamellae; context white, with pleasant, nutty flavor, and sometimes a faint odor of prussic acid; lamellae free, densely crowded, rather narrow, plane, pure-white, becoming dirty-pink and at length coppery-brown to black; spores rather broadly ellipsoid, rounded at both ends, smooth, often obliquely apiculate at the base, decidedly purplish-brown under the microscope, opaque, rather variable in size, $6–7 \times 3.5–4.5\,\mu$; stipe subcylindric, very slightly enlarged at the base, dirty-white, staining when handled, somewhat pruinose, fistulose, 10 cm. long, 2 cm. thick; annulus very large, membranous, tough, persistent, white above, brownish-floccose below, distant 1–2 cm. from the apex of the stipe.

Type collected in grass near manure heaps at Santiago de las Vegas, Cuba, May 13 and 15, 1904, *F. S. Earle 18*. Also collected on a manure pile at the edge of a lawn at Chester Vale, Jamaica, 900 m. elevation, December 21–24, 1908, *W. A. & Edna L. Murrill 265;* and at Knutsford Park, Kingston, Jamaica, January 9, 1909, *W. A. Murrill* 827.

11. AGARICUS JEJUNUS Fries, Nova Acta Soc. Sci. Upsal. III. 1: 24. 1851

Described and known only from specimens collected in the Antilles, said to be growing with *A. campester* and *A. pratensis*. Pileus gibbous, 6 cm. or more broad; surface reddish, appressed-pilose-squamulose, smooth and umbrinous on the disk; lamellae very much crowded; stipe enlarged at the base, tapering upward, white, 7.5 cm. long; annulus lacerate, evanescent.

12. **Agaricus herradurensis** sp. nov.

Pileus thin, cylindric to broadly convex, discoid at the center, solitary, 3 cm. broad; surface dry, reddish-brown, the pellicle rupturing and forming upturned floccose squamules, the disk dark-brown; margin pallid, entire, not striate; lamellae free, crowded, rather broad, dark-reddish-brown at maturity; spores

broadly ellipsoid, smooth, indistinctly obliquely papillate at the base, rather dark purplish-brown under the microscope, opaque, uniguttulate, $4–4.5 \times 2.5\,\mu$; stipe cylindric, glabrous, white, hollow, 2.5 cm. long, 4 mm. thick; annulus delicate, white, attached very near the base of the stipe.

Type collected in soil in a garden at Herradura, Cuba, August 31, 1907, *F. S. Earle 575*. Known only from the type locality. This is a very small species, with reddish-brown pileus, short, white stipe, and basal annulus.

13. **Agaricus Earlei** sp. nov.

Pileus rather thin, ovoid to convex and finally expanded, gregarious, 3–6 cm. broad; surface white, brownish on the disk, decorated with small appressed or somewhat verrucose, brownish scales; margin whitish, not striate; context white, unchanging, without odor but with pleasant taste; lamellae free, crowded, rather broad, subventricose, pink to dark-coppery-brown; spores ellipsoid, indistinctly obliquely apiculate at the base, smooth, opaque, purplish-brown under the microscope, dark-brown in mass, uniguttulate, $5 \times 3\,\mu$; stipe cylindric, abruptly discoid-bulbous at the base, pure-white, glabrous, stuffed to hollow, 4–6 cm. long, 5–10 mm. thick; annulus membranous, persistent, becoming movable, white, distant 1 cm. from the apex of the stipe.

Type collected in red clay soil in a banana field at Santiago de las Vegas, Cuba, May 17, 1904, *F. S. Earle 33*. Also collected by Earle in the same field, June 18 and 21, 1904.

14. **Agaricus xuchilensis** sp. nov.

Pileus convex to nearly plane, not umbonate, solitary, 4.5 cm. broad; surface pale-chestnut, smooth, with innate, appressed, imbricate fibrils; margin entire, concolorous; lamellae free, subcrowded, rather narrow, pallid when young and fresh, becoming blackish-brown; spores oblong-ellipsoid, smooth, distinctly obliquely papillate at the base, dark-purplish-brown to blackish under the microscope, opaque, uniguttulate, $5 \times 2.5\,\mu$; stipe slightly tapering upward, not bulbous, much paler than the pileus but similarly colored, smooth, 5 cm. long, 7 mm. thick; annulus small, membranous, persistent, white, fixed a little above the middle of the stipe.

Type collected in a rich field at the edge of a forest at Xuchiles, near Cordoba, Mexico, January 17, 1910, *W. A. & Edna L. Murrill 1156*. Known only from the type locality. This species may be readily recognized by its very dark pileus and pale lamellae.

15. **Agaricus ochraceidiscus** sp. nov.

Pileus fleshy, firm, convex to expanded, subcespitose, 6–8 cm. broad; surface dry, white, with ochraceous scales, ochraceous on the disk; context white, unchanging, with sweetish taste; lamellae free, crowded, moderately broad, ventricose, dark-grayish-lilac with reddish stains; spores quite broadly ellipsoid, smooth, opaque, decidedly purplish-brown under the microscope, rounded at both ends, $4.5–5 \times 3–3.5\,\mu$; stipe tapering upward, white, floccose, solid but somewhat spongy within, 5–7 cm. long, 6–12 mm. thick; annulus white, sometimes fugacious, distant 1 cm. from the apex of the stipe.

Type collected in red clay on a ditch bank at Santiago de las Vegas, Cuba, September 28, 1904, *F. S. Earle 265*. Also collected in the same vicinity in the autumn of 1904 and 1905, *F. S. Earle 297, 350, 379*.

16. **Agaricus Hornei** sp. nov.

Pileus convex, firm, solitary, reaching 10 cm. broad; surface dry, whitish, with small, brownish, imbricate, fibrillose scales; margin even, somewhat appendiculate; context white, unchanging, without odor and without characteristic taste; lamellae free, crowded, of medium breadth, pink to reddish-brown, not becoming black; spores broadly ellipsoid, smooth, opaque, obliquely apiculate at the base, decidedly purplish-brown, uniguttulate. $5.5 \times 4\,\mu$; stipe deeply buried but not radicate, irregularly enlarged and swollen below, silky-shining and slightly floccose above, brownish-white, spongy and hollow within, 15 cm. long, 2–3 cm. thick; annulus thick, membranous, white, persistent, distant 1 cm. from the apex of the stipe.

Type collected in soil in a field in rather dry weather at Herradura, Cuba, December 25, 1907, *F. S. Earle and W. T. Horne 579*. Known only from the type locality.

17. AGARICUS GUADELUPENSIS Pat. Bull. Soc. Myc. Fr. 15: 197. 1899

Described from specimens collected by Duss on the ground among rubbish near dwellings in Guadeloupe. The description seems to place it midway between *Agaricus* and *Lepiota*. I have not examined the type specimens.

18. **Agaricus Shaferi** sp. nov.

Pileus convex to expanded, solitary, 10 cm. or more broad; surface dry, whitish or pale-yellowish, densely covered with conspicuous, light-bay-brown scales; margin entire, concolorous; lamellae free, rather crowded, blackish-brown at maturity; spores broadly ellipsoid, smooth, opaque, dark-purplish-brown under the microscope, $5 \times 3.5\,\mu$; stipe tall and thick, enlarged at the base, whitish, fibrillose, 15 cm. long, 3–4 cm. thick; annulus ample, membranous, white, persistent, attached very near the base of the stipe.

Type collected in soil near Laguna Herradura, Pinar del Rio, Cuba, December 12, 1911, *J. A. Shafer 11269*. Known only from the type locality. This species is readily distinguished by its large size and conspicuously scaly surface. Unfortunately, the collector pressed his specmiens flat and made very brief notes; but it would seem a pity not to recognize such a splendid plant.

DOUBTFUL AND EXCLUDED SPECIES

Agaricus Sallei Berk. Ann. Mag. Nat. Hist. II. 9: 193. 1852. Known only from specimens collected on dead wood in Santo Domingo by Sallé. It is described as acutely umbonate, with minute, branlike scales, 8 cm. broad; stipe 10 cm. long and 5 mm. thick, spores broadly ellipsoid, nearly straight on one side, purple-brown, $11 \times 8\,\mu$. Berkeley thought it was a species of *Lepiota* before he examined the spores. The fact that it grew on dead wood and was acutely umbonate would indicate that it hardly belonged to *Agaricus*. No mention is made of striations on the surface.

Agaricus yucatanensis Ellis & Ev. Field Columb. Mus. Bot. ser. 1, 285. *pl. 8.* 1896. Described from specimens collected on

decaying vegetable matter in Yucatan by Millspaugh in 1895. Ellis remarked that it had the appearance of a *Lepiota* but that the spores were brown. A microscopic examination of the type shows the spores to be ovoid, smooth, slightly obliquely apiculate at the base, hyaline with a distinctly melleous tint, granular, $9 \times 5\,\mu$. This agrees very well with the characters of the spores of *Lepiota cretacea,* except for color, while in general appearance the two species are not very distinct. It is well known that some species of *Lepiota* have darkened spores.

13. COPRINUS Pers. Tent. Disp. Fung. 62. 1797

This genus is readily distinguished among the black-spored gill-fungi by its deliquescing lamellae. As at present constituted, it includes a large and heterogeneous group of species, which fall naturally into three or more groups. Professor Earle has collected a large number of specimens in Cuba, most of them of the general type of *C. plicatilis* and *C. Spraguei,* representing the genus *Coprinopsis* of Karsten, a segregate of *Coprinus,* which dry more readily than the more fleshy species usually found by collectors.

No atttempt will be made now to segregate the genus nor to study fully the material at hand. This will be left for Professor Pennington, who has undertaken to monograph the genus for *North American Flora.*

Pileus entirely white; stipe 2.5–4 cm. long .... 1. *C. cubensis.*
Pileus whitish, but differently colored on the disk; stipe 5–8 cm. long.
  Disk fulvous .... 2. *C. fimetarius.*
  Disk cinereous .... 3. *C. armillaris.*
Pileus pale-yellowish-white, somewhat darker on the disk; stipe only 2 cm. long .... 4. *C. jalapensis.*
Pileus rose-colored, very small .... 5. *C. mexicanus.*
Pileus griseous, murinous, or fuliginous.
  Stipe 1 cm. long .... 6. *C. jamaicensis.*
  Stipe 3–4 cm. long .... 7. *C. cinchonensis.*
  Stipe 5–7 cm. long .... 8. *C. Spraguei.*

1. COPRINUS CUBENSIS Berk. & Curt. Jour. Linn. Soc. **10**: 293. 1868

Described from specimens collected by Wright on logs in Cuba. The pileus is conic-ovoid, white, floccose-squamulose, 4 cm. broad; lamellae free, crowded, purplish-brown; spores not black, but rather of a purplish-brown tint, boat-shaped as in *C. micaceus;* stipe larger below, glabrous, 2.5–4 cm. long, 3 mm. thick.

2. COPRINUS FIMETARIUS (L.) Fries, Epicr. Myc. 245. 1838

Agaricus fimetarius L. Sp. Pl. 1174. 1753.

This species is abundant in temperate regions, especially on manure heaps.

Jalapa, Mexico, *W. A. & Edna L. Murrill 34.* These specimens were collected on horse manure. The spores are broadly ovoid or subglobose, apiculate, smooth, black, 12–13 × 7–8 μ.

3. COPRINUS ARMILLARIS Fries, Nova Acta Soc. Sci. Upsal. III. **1**: 28. 1851

Described from specimens collected by Oersted in the island of St. Thomas. Two very pretty colored drawings, which strongly suggest *Lepiota,* are to be found at Copenhagen, but no specimens. No reference is made by Fries to the spores.

4. **Coprinus jalapensis** sp. nov.

Pileus campanulate to broadly convex, not fully expanding, thin, solitary, 2 cm. broad; surface smooth, glabrous, striate, pale-yellowish-white, somewhat darker on the disk; margin entire, concolorous, becoming ragged with age; lamellae free, narrow, crowded, gray to blackish-brown, whitish on the edges in young stages and showing under a lens large white cystidia on the sides; spores ellipsoid, somewhat irregular in outline, smooth, purplish-brown, 6–7 × 4–5 μ; stipe tapering upward, smooth, glabrous, glistening-white, much enlarged at the base and attached to a conspicuous mass of reddish-brown mycelium, 2 cm. long, 2 mm. thick at the middle; annulus wanting.

Type collected on dead wood in woods at Jalapa, Mexico, 1,500 m. elevation, December 12–20, 1909, *W. A. & Edna L.*

Murrill 88. Known only from the type locality. This species has the appearance of *Coprinus* in the fresh state but the lamellae do not deliquesce readily. The cystidia and mass of oozonium also place it in *Coprinus,* although the dried specimens look very much like *Hypholoma*.

5. **Coprinus mexicanus** sp. nov.

Pileus obovoid to conic, expanding and deliquescing with age, having the appearance of a puffball when young, greparious to cespitose, about 1 cm. broad and high before expanding; surface pale-incarnate when young, decorated with tufts of fibrils, becoming roseous and losing most of the fibrils with age; margin concolorous, becoming revolute; lamellae numerous, very narrow, blackish-brown at maturity; spores minute, ovoid, smooth, very pale purplish-brown, almost hyaline under the microscope, $4–4.5 \times 2.5–3.5\ \mu$; stipe short, equal, somewhat fibrillose, white, 2–3 cm. long, 2 mm. thick; annulus membranous, persistent, rose-colored, attached below the middle of the stipe.

Type collected in abundance on the base of a dead, moss-covered trunk in a virgin forest at Motzorongo, near Cordoba, Mexico, 400 m. elevation, January 15, 1910, *W. A. & Edna L. Murrill 1080*. Known only from the type locality. This beautiful little species when first seen at a distance was thought to be a tiny puffball. Its rosy color and small size should readily distinguish it.

6. **Coprinus jamaicensis** sp. nov.

Pileus nearly cylindric to expanded, finally upturned and mostly deliquescing, gregarious to cespitose, 3 cm. high unexpanded, and 2 cm. broad at maturity; surface shaggy with pointed, fugacious scales, murinous, the scales fuliginous; margin striate after the scales fall away, as in *C. atramentarius;* lamellae rather crowded at first, ventricose, fuliginous, soon deliquescing; spores ovoid, smooth, nearly opaque, usually 2-guttulate, umbrinous under the microscope, $7–8 \times 4\ \mu$; stipe equal, smooth, white, rather tough, hollow, 1 cm. long, 1.5 mm. thick; annulus wanting.

Type collected on a decayed palm trunk at Castleton Gardens, Jamaica, December 14, 1908, *W. A. & Edna L. Murrill 115*. Known only from the type locality.

7. **Coprinus cinchonensis** sp. nov.

Pileus very delicate, conic, becoming campanulate, solitary, 2 cm. broad and 7 mm. high; surface gray, pulverulent, griseous with isabelline patches on the disk; margin thin, long-striate, becoming revolute with age; lamellae free or slightly adnexed, tapering behind, ventricose in front, crowded, becoming very dark brown and deliquescing at maturity; spores ovoid or broadly ellipsoid, smooth, purplish-brown, mostly 2-guttulate, 9–11 × 5–6 μ; stipe subequal, smooth, glabrous, snow-white, 3.5 cm. long, 2 mm. thick at the base and 1 mm. at the apex; annulus wanting.

Type collected on a dead log at Cinchona, Jamaica, 1,500 m. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 579*. Known only from the type locality.

8. COPRINUS SPRAGUEI Berk. & Curt. Ann. Mag. Nat. Hist. III. 4: 292. 1859

This species was described from plants collected on the ground in New England by Sprague. Berkeley reports it among Wright's collections in Cuba and remarks that the spores are smaller than those of *C. plicatilis* and of different shape.

14. CLARKEINDA O. Kuntze, Rev. Gen. 2: 848. 1891

Agaricus § *Chitonia* Fries, Hymen. Eur. 277. 1874.
Chitonia P. Karst. Bidr. Finl. Nat. Folk **32**: 482. 1879. Not *Chitonia* Moc. & Sesse, 1824.

This genus is distinguished from all the other Agaricanae by the presence of a volva. It contains very few species and none of them are known to occur in tropical North America.

NEW YORK BOTANICAL GARDEN.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—IV

Tyôzaburô Tanaka

Botrytis liliorum Y. Fujikuro sp. nov. in Shokubutsu-gaku Zasshi (Bot. Mag.) Tôkyô, 28^{320}: 228–230, 1 fig. T. 3, v, May, 1914.

Mycelia hyaline, branching, 3–12 μ across, septate and granulate inside; conidiophores projecting from the stomata of the host; solitary or two together, dark-brown in color, gradually paler toward the outer ends and nearly hyaline at the tips, 490–780 $\times$ 16–21 μ, provided with 3–4 deciduous branchlets, which are sometimes dichotomously divided at the ends; conidia 4–6 to a branchlet, pale-gray, smooth, ovoid, broadly ovoid, or nearly spherical, sometimes irregularly shaped, 28–37 $\times$ 21–31 μ, averaging 32 $\times$ 27 μ, with granules 2–3 μ, germinating at the apex or lateral surface with 1–2 germination tubes 6–9 μ diam.

On *Lilium longiflorum* Thumb.

Type locality: Taikazeiho, Taihoku-chô, Formosa (Agr. Exp. Sta. farm).

Illustrations: One halftone text-figure showing hyphae, conidiophores, and conidia.

The author compared this fungus with others of the same genus, reported as attacking the lily plant (*Botrytis canescens* and the *Botrytis* form of *Sclerotinia parasitica*), but could not find any similarity, so he described it as a new species.

Discovered by the author at the experiment farm of the Taiwan (Formosa) agricultural experiment station, among plants sent from Lûchû Island. The disease, according to the author's statement, is as bad as any other three lily diseases ever found in Japan. It affects the plant mostly on the leaves, first appearing as small spots about 1 mm. diam., immediately spreading all over the surface, causing the total decay of the host plant. The

reproductive organs of the fungus appear on the decayed portion of the plant, giving it an appearance of powdery, fine fur.

PHYLLOSTICTA (PHOMA) KUWACOLA K. Hara sp. nov. in Dainippon Sanshi Kwaihô (Journ. Sericultural Association of Japan), Tôkyô, 26^{304}: 390–391, T. 6, v, May 1917. (Japanese.)

Spots amphigenous, first minute (the size of *Sesamum* seeds), brownish, then increasing in size to 6–12 mm. diam., circular or polygonal, sometimes irregular, rufous, finally cinereous with concentric zones and determinate margins, punctate with minute black dots, mostly appearing on the upper surface of the spots; pycnidia sphaeroid or depressed sphaeroid, at first buried in the matrix, finally sub-emergent, dark-brown, 60–100 μ diam.; wall fungoid-parenchymatous, cells 5–10 μ diam.; ostiola slightly prominent or mammillate, later perforate; pycnospores numerous, ellipsoid, ovoid, cylindric or sub-fusoid, both ends rounded, nucleate at both ends but sometimes not, hyaline, $4–6 \times 2–3\ \mu$; sterigmata obsolete.

On living leaves, shoots and twigs of *Morus alba.*

Localities: Mino (Gifu-ken) and adjacent prefectures—the annual damage seems to be considerable.

The spots appear on the leaves and then gradually dry up, becoming lacerate in dry weather and rotting in rainy weather. When they appear on the margins of leaves, very frequently semi-circular holes are made; when two or more are formed close together they coalesce, becoming irregular spots which sometimes occupy considerable space on the leaf and cause the entire blade to decay. Young twigs are also attacked and quickly change to a brownish color and die, showing minute black pustules over the surface. Hard twigs when attacked by the fungus display rufous spots which later become blackish and sink considerably below the level, showing much roughness and cracking on the surface and finally causing the death of the upper part of the twig.

New Japanese name of the disease: Kuwa no Rinmonbyô (circle blotch of mulberry).

Phoma Mororum Berl. is the nearest to this species, but the pycnospores in the former species are curved while in *P. Kuwa-*

cola they are straight, and the details of pycnidial structure differ greatly in the two species.

SEPTOBASIDIUM ACACIAE Sawada sp. nov., in Nôji Shikenjô Tokubetsu Hôkoku (Special Report, Agr. Exp. Station) Taiwan (Formosa), no. **2**: 103–104, pls. 11, 12. M. 44, xi, Nov. 1911. (Japanese.)

Mycelial strands (pilea) filamentous, rigid, tightly adhering to the bark, effused, 10 cm. across, 70–180 μ thick; surface smooth, brown or tobacco-brown when dry, brunneous when wet; margin grayish-white; hyphae yellowish-brown when mature, branched, septate, 3 μ in diam.; protobasidia appearing on superficial hyphae, spherical, colorless, finely guttulate, subsessile, 9–15 μ across; basidia rising from protobasidia, easily detached, cylindric, subacute above and truncate below, straight or slightly curved, hyaline, 1–5-septate, 52–81 $\times$ 4–6 μ; sterigmata from each cell of basidia, 4–12 μ long; basidiospore hyaline, oblong to oblong-obovoid, curved, 18–22 $\times$ 3–6 μ, germinating with short tubes carrying sporidia of about the same appearance as basidiospores measuring 11–15 $\times$ 3–5 μ.

On trunks and twigs of *Acacia Richii*.

Type locality: Taihokuchô Shakukô, Formosa, Sept. 26, 1910, K. Sawada and Y. Fujikuro; l. c. Oct. 7, 1910, Y. Fujikuro.

Additional hosts and localities: On *Glochidion obovatum* (Euphorbiaceae), Agr. Exp. Station ground, Taihoku-chô Taikazeiho, Formosa, Oct. 7, 1910, Y. Fujikuro; on *Citrus* sp. Taihoku-chô Kiirun, Mar. 28, 1911, K. Sawada.

Illustrations: One halftone plate showing diseased twigs of Acacia and Glochidion; one black and white lithographic plate with 16 figures showing detailed structure of the fungus.

NOTE: It has been further reported by K. Sawada (in Nôji Shikenjô Tokubetsu Hôkoku, Taiwan, No. 11, Feb. 1915) that this fungus also occurs in Formosa on *Prunus Persica* (peach), *Prunus salicina* (plum), *Thea sinensis* (tea plant), *Salix glandulosa* var. *Warburgii*, and *Melia Azedarach*.

The affection is closely related to the attack of scale insects, and in many cases the dead insects were found embedded in the mycelial strands. The fungus sometimes kills Acacia trees

as was discovered by a forest inspector, so immediate treatment is desirable.

For the purpose of washing off the fungus, concentrated wood-ash solution (30–50 per cent.) is recommended.

CERCOSPORA PINI-DENSIFLORAE Hori et Nambu sp. nov. ex Viscount N. Nambu in Byôchû-gai Zasshi (Journ. Plant Protection, Tôkyô, 5^5: 353–354. T. 6, v, May 1917. (Japanese.)

Acervuli punctiform, minute, black; conidiophores projecting from stromata, grouped, dark-brown, about 44 μ high, 4.4 μ across; conidia filiform or long-obclavate, slightly curved or straight, pale-yellow, 4–5-, sometimes 6-septate, 41.49–50.7 × 1.23–4.6 μ.

Hyphae pale-amber, intercellular; spots yellowish-brown, usually occurring on the upper half of the leaf; disease first starts from the upper part of the plant, gradually coming down, finally causing the death of all that portion of the plant above ground.

On leaves of young plants of *Pinus densiflora*.

Type locality: Nursery of Makago, Kagoshima-ken, Major Forest Office, September 20, 1915.

A great many young plants, mostly two years old, were fatally injured in the nursery above mentioned, which is located in the southern part of Kyûshû Island. The occurrence of this disease so far as reported seems to be only local but it seems likely to prove dangerous if it is not controlled by treatment of seedlings with Bordeaux mixture, as suggested by the writer.

HELICOBASIDIUM TANAKAE Miyabe, ex K. Sawada in Shokubutsugaku Zasshi (Bot. Mag.) Tôkyô, 26^{304}: 102–105, 2 figs., M. 45, iv, Apr. 1912 (Japanese); in J. Matsumura, Index Plantarum Japonicarum (Teikoku Shokubutsu Meikwan) 1: 146, Mar. 1904. (Nom. nud.).

Stypinella Tanakae Miyabe, in K. Saida, Naigwai Futsû Shokubutsushi (Common flora of Japan and Foreign Lands) 1: 315. Aug. 1910 (Nom. nud.)

Septobasidium sp. M. Shirai in Saikin Shokubutsu Byôrigaku (Latest Plant Pathology), 3d ed., p. 356, Aug. 1907.

Mycelial strands (pilea) epigenous on trunks and twigs, first circular then increasing the area irregularly, often attaining 10 cm. diam., flat, lichenous, 1 mm. thick, surface velvety, brownish, pale-purplish-brown, or dark-brown, with very narrow thin margin grayish in color; hyphae branching, amber-colored, septate, thick-walled, granulate, in continuous row, 3–5 μ across; proto-basidia not formed; basidia consisting of free branched ends of surface hyphae swollen and more or less club-shaped, first unicellular, hyaline and very granulate but at maturity sub-fusoid, 2–4-septate, straight or curved, 49–65 × 8–9 μ, producing sterigmata on each cell; sterigmata apical in the terminal cell, lateral in others, long, curved, comparatively large, 35–63 × 3.5–4 μ; sporidia terminal on each sterigma, hyaline, unicellular, long-falcate, obtuse, 27–40 × 4–6 μ, germinating to form hyphae.

On trunks and twigs of *Morus, Salix, Vitis, Juglans, Xanthoxylum, Prunus Mume, Prunus donarium, Prunus salicina, Prunus Armeniaca* var. *Ansu, Pyrus Malus, Pyrus sinensis, Ribes Grossularia, Kerria japonica, Thea sinensis, Paulownia tomentosa, Firmiana platanifolia,* and *Pittosporum undulatum.*

Distribution: Japan, very common.

Most Japanese authorities who have described this species have confounded it with *Septobasidium pedicellatum* (Schw.) Pat. but the true *S. pedicellatum* was first discovered in Formosa by Mr. Sawada (Bot. Mag., Tôkyô, **26**[310]: 307–311, Japanese) where *Helicobasidium Tanakae* does not occur. *Septobasidium pedicellatum* seems to attack only the mulberry tree and differs in having chestnut-brown hyphae 3.5 μ across, forming an ocher-brown pileus (never purplish), and in the formation of strongly curved basidia, 24–48 × 6–8.5 μ, which develop from spherical protobasidia.

NOTE: For an account of the occurrence of *Septobasidium pedicellatum* in Honshû (Main Island), we are indebted to Prof. A. Yasuda, who reported it from Kôdzuke-no-kuni (Prefecture Gumma-ken) Setagun (Bot. Mag. Tôkyô, **28**[335]: 447, Nov. 1914. Japanese). Hara later states that it occurs commonly in the main island (Dainippon Sanshi Kwaihô, Journ. Seric. Assoc. Japan, **25**[296]: 713, Sept. 1916). It has also been collected by Miyake at a place near Tôkyô (Sangyô Shikenjô Hôkoku **1**[5]: 333, Dec. 1916), and recently T. Watanabe reports that it is *S. pedicel-*

latum, not *Helicobasidium Tanakae,* which occurs on mulberry trees in the vicinity of Tôkyô (Sangyô Shimpô, Journ. of the Silk Industry, Tôkyô, 25^{287}: 88, Feb. 1917).

The last paper mentioned gives an interesting account of the parasitic nature of both species, not merely epiphytically covering the surface of the host as reported before. The hyphae, rather finer, measuring 3 μ across, almost colorless, attack the outer layer of phelloderm, entering mostly through complementary cells of lenticels, and there making conspicuous intracellular development, which is shown by penetrated cell-walls and well-nourished hyphae containing plenty of oil globules.

NOTHOPATELLA MORICOLA I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Rept. Imperial Sericultural Exp. Station) Tôkyô, Japan, 1^5: 344, pl. 17, figs. 15, 16, T. 5, xii, Dec. 1916. (Japanese.)

Pycnidia hypo-epidermal, conoid-pustulate, later erumpent, irregular, black; walls indefinitely pseudo-parenchymatous, not evidently differentiated from the matrix, forming pseudostromata, multilocular; ostiola simple, opening at the elevated portion of the pycnidia; conidia usually ellipsoid, rarely ovoid or elongate, nucleate with a comparatively large, greenish, oil-globule at each end, first colorless and hyaline, later olivaceous, unicellular, 2.7–3.8 $\times$ 1.5–2.5 μ; conidiophores covering the whole inner surface of pycnidia, abundant, hyaline, filiform, 10–14 $\times$ 1 μ.

On twigs of *Morus alba.*

Type locality: Iwate-ken, Morioka-shi, Apr. 5, 1915, I. Miyake.

Illustrations: Two lithographic figures showing pycnidium and conidia.

USTULINA MORI K. Hara sp. nov. in Dainippon Sanshi Kwaihô (Journ. of Sericultural Association, Japan), 26^{304}: 389. May 1917. (Japanese.)

Stromata superficial, effused, 1–4 cm. in diam., 2–3 mm. thick, first carnose, later rigid, lacquer-black or dusky-black, whitish inside, sometimes more or less repand, surface uneven, punctate with black dots, margin more or less rounded; perithecia immersed, seriately closely aggregated near the surface, ovoid, large,

1–1.2 mm., with punctiform ostiola, perforate; asci cylindric or clavate, rounded above, long-pedicellate below, 110–140 × 10–12 μ, octosporous, paraphysate; ascospores monostichous, ovoid, ellipsoid, or indefinitely fusoid, blunt, continuous, 1–2 nucleate, dark-colored, 7–10 × 4–5 μ; paraphyses filiform, simple, longer than asci, 1–1.5 μ across.

On trunks of *Morus alba.*

Type locality: Mino (Gifu-ken prefecture), Kawakami-mura, April, 1913, K. Hara.

Differs from *Ustulina microspora* in the shape and dimensions of ascospores.

VALSA PAULOWNIAE Miyabe et Hemmi.

Besides the description in Japanese translated in *Mycologia* for May, 1917, two other descriptions of the fungus have been published by one of the authors, Dr. Hemmi. All three descriptions are marked "n. sp." The first article to be published with the original description of the fungus (in English) appeared in Sapporo Hakubutsu Gakukwai Kwaihô (Transactions of the Sapporo Natural History Society), 6^2: 133–158, text-figs. 1–4, issued July 31, 1916. This article gives a full account in Japanese of the disease caused by this fungus and compares it with other similar diseases. The third and last of these articles is published in English in the Shokubutsu-gaku Zasshi (Botanical Magazine) Tôkyô, 36^{357}: 304–313, text-figs. 1–4, issued Sept. 20, 1916. This article also gives a description of *Valsa Paulowniae* n. sp. in English. One of the figures (Fig. 4) in each of these articles gives the detailed microscopic structure of the fungus. The other three figures show effects of the fungus on Paulownia trees. Dr. Hemmi notes that the fungus was first collected in Aomori-ken in N. Honshû in August, 1903, by Mr. T. Nakamura and reported then as causing a very destructive disease of the "Kiri" tree. All three articles are of importance in throwing light on a very dangerous *Paulownia* disease of Japan which is analogous to chestnut blight in America, both in its swift destructive action and in causing the loss of timber much valued for cabinet-making.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NEW SPECIES OF RUSSULA FROM MASSACHUSETTS

Gertrude S. Burlingham

In October, 1916, Mr. Simon Davis sent me for examination and identification an interesting collection of *Russula* made in the vicinity of Stow and South Acton, Massachusetts. Twenty species were represented, including *R. fallax* Fr., *R. fragiliformis* Burl. (*R. fragilis* Fr.), *R. glauca* Burl., *R. heterophylla* Fr., *R. insignis* Burl., *R. integra* (L.) Fr., *R pectinatoides* Pk., and *R. veternosa* Fr. Eight other species I have reserved for further study, either awaiting notes regarding some particular point should the same species appear another season, or comparison with European material. Four species, however, differ so much from any related European or American *Russula* that they seem entitled to rank as new species. All of these were accompanied with careful and complete field notes and spore prints, and the dried plants were in excellent condition and in sufficient quantity to give a good idea as to the possible variations.

Russula Davisii sp. nov.

Pileus broadly convex, depressed in the center, becoming expanded with the margin drooping, up to 18 cm. broad; surface entirely Pinard-yellow, or tinged with dull-reddish on the margin, viscid when wet, with separable pellicle, pruinose when young, then glabrous; margin even, at least the striations not pronounced; context white, firm but brittle, mild without special odor; lamellae buff-yellow when developed, equal, forking near the stipe, venose-connected, pilose, narrowed at the inner end, adnexed to slightly decurrent, broad at the outer end, up to 13 mm. broad, subdistant; stipe more or less washed with bluish-pink, very slightly discoloring grayish or sordid, expanding at the apex, tapering downward, rather firm, spongy, becoming hollow, glabrous, up to 7 cm. long and from 2 to 3 cm. in diameter; spores ochraceous, ellipsoid, coarsely and abundantly echinulate, $10–12 \times 8.5–10\,\mu$; cystidia $50\,\mu$ or more long by $18\,\mu$ wide.

TYPE LOCALITY: Stow, Massachusetts.

HABITAT: On damp ground under chestnut trees, solitary or gregarious, August 7 to September 22.

RELATIONSHIP AND CHARACTERISTICS: This species seems to be related to the Betulinae group. The lamellae do not discolor at all and the discoloring of the stipe is so slight that it might easily be overlooked, so that it does not seem to be related to the Decolorantes. It can easily be distinguished by the general yellow color of the pileus and the reddish stem. The flesh is nearly as compact as in some species of the Compactae. The pruinose-pilose lamellae forking at the inner end, and the unequal stipe with its slight discoloration are some of the characteristics which prevent its being considered a yellow form of *Russula alutacea* Fr.

Russula disparalis sp. nov.

Pileus broadly convex, becoming expanded and depressed in the center, up to 5.5 cm. broad; surface buff-yellow near the margin, Apricot-yellow toward the center, Sandford's brown to Auburn or Hessian-brown on the disk, viscid when wet, with separable pellicle, pruinose, otherwise glabrous; margin striate and obsoletely tuberculate, inrolled until mature; context white, taste subacrid, odor not distinctive; lamellae white, mostly equal but a few not long enough to reach to the stipe, adnexed and rounded next the stipe, rather broad, subcrowded; stipe white, equal, spongy, becoming hollow, glabrous, rugose, subflexuose to straight, up to 5.5 cm. long and 1.5 cm. in diameter; spores ochroleucous, broadly ellipsoid, uniguttulate, apiculate, minutely echinulate, $8.7–10 \times 6–7.5\,\mu$, from 1.5 to $1.8\,\mu$ being taken up by the point at the apex of the spore.

TYPE LOCALITY: Stow, Massachusetts.

HABITAT: Under chestnut trees in damp ground near a swamp. Also under *Pteris aquilina, Osmunda cinnamomea, Osmunda regalis,* black and white birch, and alder. Found from August 4 to September 11.

RELATIONSHIP AND CHARACTERISTICS: This species belongs to the group Palustres. It may be recognized by the contrasting yellow margin and the dark-brown center, and the pure-white stipe. It is so different in appearance from other species of

Russula that I have given it the specific name "disparilis" or the unlike *Russula.*

Russula pulchra sp. nov.

Pileus convex, becoming plane to slightly depressed in the center, up to 8 cm. broad; surface Nopal-red on the margin, scarlet-red next and scarlet on the disk, or peach-red except on the margin, viscid when wet with pellicle separable on the margin, pruinose for some time, all except the disk becoming areolate with age; margin tuberculate-striate, inrolled; context white, mild, without special odor; lamellae white, equal, margin entire, forking next the stipe, venose-connected, broadest next the margin, adnate, thin, subdistant; stipe white, inclined to be pointed at the base, spongy-stuffed to hollow, glabrous, rugulose, up to 7 cm. $\times$ 2 cm.; spores cream-white, ellipsoid to egg-shaped, echinulate, uniguttulate, 8.7–10 $\times$ 7.5 μ.

TYPE LOCALITY: Stow, Massachusetts.

HABITAT: In swamp, gregarious, August 27 to September 22.

DISTRIBUTION: Found also at South Acton, Massachusetts, and Wardsboro, Vermont.

RELATIONSHIP AND CHARACTERISTICS: This species seems to belong with the Subvelutinae group, although the nearly white spores might remind one of the Purpurinae group. The pileus is more velvety-pruinose when young, and more broken into areolae when mature than is the case with species of the latter group, and is more brilliant than in any other species having a mild taste and nearly white spores. The stem is white or has merely a blush of red. The description of *Russula paludosa* Britz. as given in Revis. Hymen. IV: 17. 1899, agrees with this species except in the simple lamellae and the scabrous margin of the pileus; but if *R. paludosa* is the same as *R. elatior* Lindbl. as Maire thinks[1] then there is no question regarding the two being distinct; since I have several specimens of *R. elatior* Lindbl. which Professor Romell sent me, and *Russula pulchra* is quite distinct. *Russula elatior* has very much the same appearance as our *Russula rubrotincta.* In fact, specimens of this which I sent to Professor Romell he thought must be that species and suggested to me that I be sure that young specimens of the plants

[1] Bull. Soc. Myc. France 26: 65.

which I had sent him were not acrid. During the following season I tested these in all stages and found the taste in all cases to be sweet and nutty, reminding one of the taste of beechnuts. The spores of *Russula pulchra* appear white except in mass on white paper when they show cream-white. Under the microscope, the spores appear much rougher than spores of *R. uncialis* Pk. The color of the spores in mass will serve to distinguish the species from *R. subvelutina* Pk.

Russula perplexa sp. nov.

Pileus becoming centrally depressed to infundibuliform, up to 7 cm. broad; surface Acouje-red to Dragon's blood-red or salmon-buff with amaranth-purple intermixed in the center, or even salmon-buff in the center to Apricot-yellow or coral-pink elsewhere, viscid when wet, cuticle separable nearly to the center, pruinose, otherwise glabrous; margin tuberculate-striate, inrolled; context white, thin toward the margin, mild, without special odor when fresh but sour in drying, fragile; lamellae white, equal, simple, margin entire, broadest at outer end, adnate, close, thin, pruinose; stipe white washed with red, tapering downward, becoming hollow, 7.5 cm. long by 5 mm. thick; spores white, echinulate, ellipsoid, apiculate, $10 \times 7.5\,\mu$ including the apex.

TYPE LOCALITY: Stow, Massachusetts.

HABITAT: Mixed woods in a swamp, gregarious to solitary, July 30 to September 14.

RELATIONSHIP AND CHARACTERISTICS: This species belongs in the Purpurinae group. It differs from *R. uncialis* Pk. in its larger size, infundibuliform pileus, and pronounced tuberculate-striate margin; from *R. purpurina* it differs in the edge of the lamellae being even, and the lamellae not becoming yellow with age, and scarcely so in drying; from *R. Linnaei* Fr. in the viscid, pruinose pileus, in the simple lamellae which do not become yellow, and the tuberculate-striate margin. It differs from all of these in the sour odor which develops during drying.

It is about the size and texture of *R. fragiliformis* Burl. and may be recognized by the somewhat vinous-red color, with or without buff color, the infundibuliform mature pileus, the mild taste, and white spores.

556 LAFAYETTE AVENUE,
BROOKLYN, N. Y.

NOTES AND BRIEF ARTICLES

Max W. Gardner, of the Bureau of Plant Industry, has been appointed instructor in plant pathology in the University of Michigan.

F. D. Heald has been appointed head of the new department of plant pathology recently established by the regents of the State College of Washington.

W. J. Spillman, of the United States Department of Agriculture, has been appointed dean of the newly created college of agriculture at the State College of Washington, where he will enter upon his duties on April first.

J. E. Fries, of Birmingham, Alabama, called at the Garden on January 21 with a handsome specimen of the parasitic gill-fungus, *Asterophora Clavus*, preserved in alcohol, which he donated to the Garden collection. While here, he took a full subscription to *North American Flora.*

A number of appointments have recently been made at the Bureau of Plant Industry in Washington: R. A. Jehle, from Florida; J. K. K. Link, from the University of Nebraska; J. C. Walker, from the University of Wisconsin; W. W. Diehl, from Clemson College, South Carolina; D. C. Neal, from Alabama; and H. F. Bergman, from the University of Minnesota.

Phytopathology is now to appear monthly, at $5.00 a year. The January number, issued late in January, is very handsome and gives promise of even greater success for this important publication.

Several leaf-spot diseases of economic plants in Porto Rico were described by L. E. Miles in the October number of *Phytopathology*.

Chrysomyxa Weirii on *Picea Englemanii,* and *Melampsora occidentalis* on species of poplar were described as new by H. S. Jackson in the October number of *Phytopathology*.

A brief and interesting review of an article by Naumov on "Intoxicating Bread" appeared in the October number of *Phytopathology,* under the authorship of Michael Shapovalov.

A specimen of *Sebacina spongiosa,* described as new by C. G. Lloyd, has been recently collected at Nassau, New Providence, Bahamas, by L. K. Brace and forwarded by him to Dr. Britton for the Garden herbarium.

S. W. Newell reports in the *West Indian Bulletin* that several species of *Rosellinia* cause root diseases in Guadeloupe, Dominica, Martinique, Grenada, and adjacent islands, the plants mostly attacked being cacao, coffee, limes, and arrowroot.

The development of some species of *Pholiota* is discussed by W. H. Sawyer, Jr., in the September number of *The Botanical Gazette.* Three species were used in Mr. Sawyer's experiments, *Pholiota adiposa, P. squarrosa,* and *P. flammans.* The paper is illustrated with six plates containing fifty-five figures.

A very important and timely treatise on the control of diseases and insect enemies of the home vegetable garden, by W. A. Orton and F. H. Chittenden, has recently appeared as Farmer's Bulletin 856 of the U. S. Department of Agriculture. This bulletin consists of 72 pages and 82 figures and contains descriptions and methods of control of all the ordinary diseases and insect pests met with in the vegetable garden.

A twig and leaf disease of *Kerria japonica,* due to *Cocomyces Kerriae* sp. nov., is described at some length by V. B. Stewart in the December number of *Phytopathology.* The disease not only causes a premature fall of the leaves but also affects the shoots, often injuring the bushes to such an extent that they die during the winter. A sulphur fungicide is recommended for checking the disease.

The occurrence of walnut blight in the eastern United States is discussed by S. M. McMurran in Bulletin 611 of the U. S. Department of Agriculture. This disease, caused by *Bacterium Juglandis,* has been established on the Pacific coast for some time, where it attacks the Persian walnut. The development of immune or highly resistant varieties is being attempted.

An article on the crown canker disease of roses, with several illustrations, by L. M. Massey, appears in the December number of *Phytopathology.* This disease is caused by *Cylindrocladium scoparium,* which has hitherto been considered a saprophyte and not supposed to occur on roses. No method of control has been discovered, but rose-growers are cautioned to sterilize their soil and use only healthy stock.

John A. Stevenson reports in the December number of *Phytopathology* that a new and alarming cane disease appeared in the western end of Porto Rico two years ago and is still spreading at a rapid rate, with a loss of from ten to fifty per cent. in the crop in two years and a total loss the third year after infection. Continued efforts have been made to ascertain the cause of this mottling disease but without result. All control measures that have been tried have also failed.

Continuing his list of wood-destroying fungi which grow both on coniferous and deciduous trees, James R. Weir lists in the October number of *Phytopathology, Daedalea confragosa* on *Abies grandis, Daedalea unicolor* on *Abies lasiocarpa, Polyporus*

albellus on *Abies grandis, Polyporus elegans* on *Tsuga heterophylla, Schizophyllum commune* on *Tsuga heterophylla, Trametes carnea* on *Arbutus Menziesii, Trametes hispida* on *Pseudotsuga taxifolia, Trametes serialis* on the aspen, and *Trametes variiformis* on *Betula occidentalis.*

Two very important matters discussed at the recent scientific meetings at Pittsburgh were: (1) the problem of disease control in order to increase crops, and (2) the establishment of a Botanical Abstracts Journal. The first has been taken up with zeal by the phytopathologists under Professor H. H. Whetzel, and the second is in the hands of a representative committee, which hopes to begin such a journal this year, under the editorship of Professor B. E. Livingston. Of the one thousand scientists in attendance at Pittsburgh, about two hundred were botanists.

Sparassis radicata is a new species described by J. R. Weir in the June number of *Phytopathology* from Idaho, where it occurs parasitically on the roots of several western conifers. This species is chiefly distinguished by its thin lobes and an unusually large perennial rootstalk, which is of the nature of a sclerotium and from which new sporophores are developed from year to year. The mycelium attacks the bast of the roots and later the wood, producing a yellow or brown, carbonizing rot. The species has been found in British Columbia, Washington, Oregon, Idaho, and Montana.

It is reported by Trumbull and Hotson in the December number of *Phytopathology* that the very attractive forestry building of the Alaska-Yukon-Pacific Exposition at Seattle, which was built of green logs of Douglas fir and western hemlock, has been seriously attacked by *Fomes ungulatus,* and that many of the sporophores of this fungus have appeared on the logs used in the building. A heating system was installed to dry the timbers and impregnation of the wood with fungicides was tried, but without result. Roentgen rays were then experimented with, but the effects observed on the fungi were negative.

A very handsome and beautifully illustrated handbook of the Amanitas of the eastern United States, by W. C. Coker, appeared last summer as a double number of the *Journal of the Elisha Mitchell Scientific Society*, published at Chapel Hill, North Carolina. This handbook contains the results of the work of years in the vicinity of Chapel Hill and other parts of eastern North America. Dr. Coker and his assistants have collected a great many specimens and made excellent notes and photographs of them. Seven species of *Amanitopsis* are recognized and nearly thirty species of *Amanita*, most of them illustrated with halftones. Although some mycologists may not entirely agree with all of Dr. Coker's conclusions, they cannot question his scientific activity and the quality of his photographs.

A very interesting collection of fleshy and woody fungi was recently sent to the Garden for determination by Miss M. McKenny, of Olympia, Washington. The collection contained good dried specimens, colored drawings, complete field notes, and spore prints. Some of the specimens were also dipped in paraffin and sent in a fresh condition; a method which seems to work very well with firm specimens that are not infested with insects. Among the species in this collection, may be mentioned: *Armillaria albolanatipes,* a perfectly sterile form of *Stropharia ambigua,* and a species of *Venenarius* which seems to lie somewhere between *V. pregammatus* and *V. umbrinidiscus.* Miss McKenny also reports having tested *Stropharia ambigua* and found it to be edible; which is a valuable thing to know, since this species is exceedingly abundant on the Pacific coast.

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ILLUSTRATIONS OF FUNGI

MYCOLOGIA

VOL. X MAY, 1918 No. 3

ILLUSTRATIONS OF FUNGI—XXVIII

WILLIAM A. MURRILL

All of the fungi represented on the accompanying plate are polypores and most of them common species, occurring on dead wood and aiding in the destruction of timber. Some of them may attack living wood, especially when weakened from other causes. The figures were drawn from fresh specimens by Miss Eaton.

Pycnoporus cinnabarinus (Jacq.) P. Karst.

Trametes cinnabarina (Jacq.) Fries

CINNABAR-COLORED PYCNOPORUS

Plate 6. Figure 1. $\times 1$

Pileus convex-plane, dimidiate, laterally extended, reviving the second season, $4–6 \times 5–10 \times 0.5–1$ cm.; surface azonate, rugulose, pruinose to tomentose, at length glabrous, the color changing from light-orange to cinnabar-red, often fading with age; margin acute, except in large plants faintly zonate; context floccose, elastic, zonate, reddish; tubes nearly equaling the context, firm, miniatous within, the mouths small, 2–3 to a mm., regular, coccineous, dissepiments rather thin, entire; spores smooth, hyaline, $6–8 \times 2–3\ \mu$.

A highly-colored species occurring on dead wood of various deciduous trees in the United States and Canada. It is not unusual to find it on old cherry logs in open fields. A thinner plant, *P. sanguineus*, is one of our commonest tropical species.

[MYCOLOGIA for March (10: 53–106) was issued April 4, 1918.]

Poronidulus conchifer (Schw.) Murrill

Polystictus conchifer (Schw.) Sacc.

SHELL-BEARING PORONIDULUS

Plate 6. Figure 2. × 1

Pileus thin, coriaceous, dimidiate to flabelliform, usually narrowly attached, conchate, springing from a sterile, cup-like structure, which usually appears on the mature sporophore near the base, 1.5–2 × 2–4 × 0.1–0.2 cm.; surface white to isabelline, with pale-latericeous zones, finely tomentose to glabrous, the sterile portion avellaneous, with narrow, black, concentric lines; margin thin, concolorous, undulate; context very thin, membranous, white, less than 1 mm. in thickness; tubes short, about 1 mm. long, thin-walled, white, mouths angular, irregular, 3 to a mm., edges thin, uneven, dentate; spores ellipsoid, smooth, hyaline.

Very common on dead elm branches in the eastern United States and Canada. It occurs rarely on a few other deciduous trees. None of our other polypores produce the peculiar sterile cups, which appear on the fertile hymenophores as "shells."

Polyporus Polyporus (Retz.) Murrill

Polyporus brumalis (Pers.) Fries

WINTER POLYPORUS

Plate 6. Figure 3. × 1

Pileus circular, convex to plane, slightly umbilicate at times, 2–8 × 0.2–0.4 cm.; surface fuliginous, more rarely yellowish-brown, hispid-squamulose to minutely hispid; margin at first inflexed, thin, fimbriate, often becoming wavy or lobed; context milk-white, membranous, 1–3 mm. thick; tubes adnate, white to pallid, 1–2 mm. long, cylindric, mouths circular, regular, 2–3 to a mm., edges at first thick, becoming thin and often dentate with age; spores cylindric, subcurved, hyaline, 7–8 × 2–3 μ; stipe central, solid, woody, equal, squamulose, avellaneous, not black at the base, 2–3 cm. long, 3–7 mm. thick.

Common in North America and Europe, especially northward, on decayed fallen branches, stumps, and roots of various deciduous trees. It may be found at almost any time during the winter months, as well as in autumn. Species of this form, with central stipe, constitute the genus *Polyporus* as at present limited, which includes nearly forty North American species.

Bjerkandera adusta (Willd.) P. Karst.

Polyporus adustus (Willd.) Fries

SCORCHED POLYPORUS

Plate 6. Figure 4. × 1

Pileus cespitose-imbricate, decurrent, sometimes effused, conchate, fleshy-tough or corky, somewhat flexible when dry, 2–4 × 4–8 × 0.2–0.4 cm.; surface undulate, indistinctly zonate, especially near the margin, finely tomentose or villose, isabelline with slightly darker markings; margin thin, undulate, sterile, pallid, usually becoming black as though scorched; context fibrous-corky, white, 1–3.5 mm. thick; tubes short, 1 mm. or less, smoky-white to blackish within, mouths regular, angular, 5–6 to a mm.; spores ellipsoid-allantoid, smooth, hyaline, 3–5 × 1.5–2.5 μ.

This is a cosmopolitan species, very abundant everywhere on dead wood and known under many names. Its grayish-black hymenium will distinguish it from most other polypores.

Tyromyces amorphus (Fries) Murrill

Polyporus amorphus Fries

RED-TUBED TYROMYCES

Plate 6. Figure 5. × 1

Pileus coriaceous, sessile, effused-reflexed, or occasionally resupinate, 0–2 × 1–3 × 0.1–0.3 cm.; surface whitish or cinereous, villose-pubescent or tomentose, marked with narrow concentric zones; context white, 1–2 mm. thick; tubes less than 2.5 mm. long, the mouths angular, thin-walled, flesh-colored to orange or brick-red, averaging 2–4 to a mm.; spores allantoid, hyaline, 4–5 × 1–2 μ; cystidia none; hyphae not much branched, 3–5 μ.

This species is rare in most sections, having been found on pine and a few other conifers in the northern United States and southern Canada. The above description is taken from an article by Overholts in *Mycologia* for September, 1917. In Europe the species has been frequently found on pine and fir and has received several names, one of which was assigned by Sowerby in 1814 and taken up by Romell as *Polyporus irregularis* (Sow.) Romell.

Cerrena unicolor (Bull.) Murrill

Daedalea unicolor Fries

ONE-COLORED CERRENA

Plate 6. Figure 6. × 1

Pileus coriaceous, sessile, imbricate, dimidate to flabelliform, conchate, often laterally confluent, 2.5–3.5 × 5–10 × 0.1–0.3 cm.; surface villose-strigose, rugose, zonate, plicate, isabelline to fulvous, becoming avellaneous with age and blackish and nearly glabrous behind; margin acute, undulate to lobed, paler, zonate, strigose-tomentose; context very thin, membranous, white, homogeneous, scarcely 1 mm. thick; tubes decurrent, labyrinthiform, 1–3 mm. long, white or isabelline to fuliginous or umbrinous, averaging 2 to a mm., edges acute, uneven, soon becoming dentate-lacerate, giving the hymenium an irpiciform appearance; spores ovoid, smooth, hyaline, 4–6 × 3–4 μ; cystidia none.

Very common on dead wood in the north temperate zone. It has been found to be parasitic on several deciduous trees. The walls of the furrows soon split up into teeth resembling those of *Coriolus prolificans* or some species of *Hydnum* or *Irpex*.

NEW YORK BOTANICAL GARDEN.

UREDINALES OF COSTA RICA BASED ON COLLECTIONS BY E. W. D. HOLWAY

J. C. Arthur

A recent writer has said that "Costa Rica is an oasis of progress in that long reach of country which extends from the Rio Grande to the equator. It is the one Central American nation which has lifted itself fully out of the anarchy of mercenary revolutions and of semi-savage internal warfare and intrigue." The country is largely mountainous, and fully eighty per cent. of the inhabitants of the highlands are pure Caucasian, mainly of Spanish ancestry. Schools are abundant. The natural scenery of the country is surpassingly beautiful and the climate of the highlands agreeable.

The chief cities and best known mountain peaks lie along the tenth meridian of north latitude, and the only line of railroad, excepting two or three short spurs, extends along this meridian from Limón on the Atlantic side to Puntarenas on the Pacific side, a distance of about one hundred and seventy miles, or considerably less than from Detroit to Chicago. The two largest cities, San José, the capital, and Cartago, lie about half way from coast to coast, approximately on the eighty-fourth degree of west longitude, or directly south of Bay City, Michigan, or less accurately of Toledo, Ohio, and but twelve miles apart by rail, being on either side the continental divide at an elevation above the sea nearly the same as that of Denver, Colorado. The two highest volcanoes, Irazú, 11,000 feet, and Poás, 8,000 feet, sometimes active, present no difficulties in their ascent, except the tediousness of rough trails and the inconvenience of mists and frequent rains.

Owing to the primitive accommodations for travelers in small towns and the almost entire absence of good highways, only the immediate vicinity of the railway is likely to receive much attention from students of mycology and natural history in general for

some time to come, unless some intrepid explorer should chance to take a fancy to roughing it in Costa Rica.

The soil is exceedingly rich, and vegetation is luxuriant. On the Atlantic side the slope is gradual from the continental divide to a wide stretch of marsh and low land along the coast, and owing to the almost daily precipitation during every month in the year it is a nearly impenetrable jungle of forest and swamp. On the Pacific side of the divide the country is more mountainous, forming a plateau dropping rapidly on its western border to the Pacific coast, and with a well-marked dry season between November and April. This highland portion of the country has a moderate climate in which not only coffee, the staple crop, and other kinds of tropical vegetation flourish, but also potatoes, corn, cereals and most of the garden vegetables of the temperate zone. Under such conditions a native vegetation of extraordinary richness and diversity flourishes, which is allied somewhat more to that extending southward into South America than to that extending northward.

The only resident of Costa Rica who has paid attention to its fungous flora, so far as the writer knows, is Sr. Adolfo Tonduz, for many years associated with the Museo Nacional at San José. He is the author of a pamphlet on the coffee-leaf disease caused by a hyphomycete. In the following list he is credited with ten collections, most of which were transmitted to the writer by Dr. N. Patouillard, Neuilly-sur-Seine, France. He is an earnest student of the general flora of the country. Phanerogamic collections by him are to be found in many herbaria, and from three of these collections specimens of rusts have been taken.

Undoubtedly the best authority at present upon the higher plants of Costa Rica is Mr. Henry Pittier, now at the National Herbarium, Washington, D. C. He is the author of a botanical handbook of 176 pages (Ensayo sobre las Plantas Usuales de Costa Rica. 1908), and has contributed studies of the native flora to the "Contributions from the National Museum." Two collections of rusts by him are mentioned in the following list, both on the so-called Irish potato, as it is found growing wild on the upper slopes of the Volcán de Irazú.

In 1913 Mr. Ellsworth Bethel, of the State Museum, Denver, Colo., paid a brief visit to Costa Rica and contributed two specimens of rusts toward the present list. The collection of one rust is also credited to H. Polakowsky.

Aside from the above eighteen collections and one specimen contributed by the Royal Herbarium, Kew, England, the material which goes to make up the following account of the rusts of Costa Rica was supplied by Professor E. W. D. Holway, of the University of Minnesota. Of the 118 species in the list all are represented among his collections, except three that are reported solely by Sr. Tonduz. The 208 specimens in the Holway material were obtained during a trip to Costa Rica in the winter of 1915–16, made for the special purpose of collecting rusts. Professor Holway is an experienced and able collector. His home has been in Iowa and Minnesota, but he has traveled extensively and has searched for rusts not only in the United States and Canada, but also in various sections of Mexico, Guatemala, Panama and the West Indies.

Professor Holway entered Costa Rica at Limón on December 9, 1915, and proceeded at once to San José. His first impressions must have been of disappointment, judging from his brief letters to the author. On December 10 he writes: "Arrived last night. Costa Rica is too civilized, not near as interesting as Guatemala." Three days later he says: "This country has climate, but not much else—no Indians, no great native markets, absolutely no native manufacture except a crude large jar made by hand entirely. I mourn for Guatemala." Not only was he at first disappointed as a traveler in the lack of strangeness and picturesqueness, but also as a collector because long, tiresome walks must be taken to reach favorable surroundings for rusts. In the vicinity of the larger cities "every inch is pastured or used for coffee," as he says, "and the wild plants have no place to stay." But if his spirits at first were depressed by these unexpected evidences of material advancement and prosperity, they rose later as he became acquainted with the less conventional parts of the country. On January 9, 1916, he writes: "I am just in from Volcán de Poás. The 'rain-forest' on the summit is magnificent. I never

saw anything like it. Wonderful flowering trees and vines with enormous blooms, and of course epiphytes in great numbers. However, it began to rain as we reached the woods, and it blew fifty miles an hour. The trail, one to two feet deep in mud and water, was certainly fierce!"

After about six weeks in Costa Rica, which included a trip to the Pacific coast and an ascent of Volcán de Irazú, Professor Holway departed by way of Limón on January 23, 1916. The quantity of material secured was somewhat disappointing, partly due to the unfavorable season, but it was rich in interesting forms, every fifth species being new to science or else to North America. The general impression left by the experience could doubtless be expressed in the sentiment of the words with which the Calverts close their recent volume on "A year of Costa Rican natural history." They say: "Our most cherished dream is of returning to the Enchanted Land."

There is one rust which Professor Holway fortunately did not find. In the herbarium of the Missouri Botanical Garden there is a specimen labelled "Hemileia vastatrix, on coffee, Costa Rica, distributed in Tonduz' Enfermedad Cafetera, 1893." The small portion of this specimen, which the writer has been privileged to examine, yielded no rust, but did bear some other fungus. In December, 1915, I wrote to Professor Holway, who was then in Costa Rica, about this specimen, and at his suggestion enlisted the assistance of Mr. F. Nutter Cox, British Consul at San José, who is interested in coffee production, and has considerable botanical knowledge of the region. Mr. Cox transmitted a letter from Sr. A. Tonduz, of the date of May 8, 1916, who is now officially connected with the Department of Agriculture of Costa Rica, and considerately gave a translation from the Spanish original. The part of the latter which follows puts the matter very clearly.

"In 1893 my pamphlet on 'A coffee leaf disease' (Enfermedad del cafeto) was accompanied by dried leaves of coffee attacked by *Stilbum flavidum,* a fungous growth causing 'maya' or 'virucla,' the disease which formed the subject of the study or thesis. I do not know to whom it has occurred to label these

specimens *Hemileia vastatrix,* which are affected with 'maya,' a very common disease in San José. To my knowledge *Hemileia vastatrix* has not at any time invaded the American continent, its dependencies, or the West Indies."

Mr. Cox in his letter of May 12, 1916, says: "Evidently someone, not Tonduz, has blundered, and knowing by hearsay of *Hemileia vastatrix* as a coffee-leaf disease, has assumed that Tonduz' specimen leaves of a coffee-leaf disease were affected by the disease he or she had read about, i. e., *H. vastatrix.* I personally have never seen or heard of *H. vastatrix* in Costa Rica, nor known of anyone else who has, and there is not the slightest difficulty in recognizing it."

The coffee-leaf rust, *H. vastatrix,* doubtless does not occur in the western hemisphere at the present time. It was first admitted to the North American flora on the strength of a statement that it was once found in Porto Rico. It certainly does not exist there now, whatever truth may have been in the report, and has not recently been heard of from any other locality in either North or South America, or in the adjacent islands. The entries in the *North American Flora* (7:150. 1907), and in Sydow's Monographia Uredinearum (3:210. 1914), should be cancelled.

When the possibility was being considered that the coffee rust did occur in Central America, Professor Holway wrote under date of March 2, 1916, as follows: "The first two collections of the Inga rust [which I made in Costa Rica] were on young plants, four feet high, growing with coffee plants, one growing from the same spot as a coffee tree. The likeness in young specimens is remarkable—several natives saying at once that the Inga was coffee. Fresh, young shoots are practically identical. The importance of the rust prevented my being caught. I first found the taste quite different and later discovered a larger tree of Inga, in which the close resemblance disappears. It is evident that future reports of the occurrence of the coffee rust, not founded upon examination of the fungus, must be taken with caution."

This first presentation of 118 species of rusts for Costa Rica, here given, including 22 species new to science and 12 previously

known from South America but new to North America, besides many new hosts and much extension of range for numerous other species, is certainly a fine showing for a country whose width from ocean to ocean is not half the distance from Chicago to Detroit, and for an area covered by observation not equal to the State of Rhode Island. Doubtless a general exploration of the 23,000 square miles of territory embraced in Costa Rica will fully demonstrate the great richness and importance of its rust flora, as has been shown for certain flowering plants, insects, and other natural history groups, both plant and animal.

The study of the Costa Rican rusts has constituted a part of the preliminary work on the rust flora of North America being prosecuted as a special project at the Purdue Agricultural Experiment Station, Lafayette, Ind. Credit is due to the several members of the laboratory staff who during the last two years or more have assisted in the work.

Family: COLEOSPORIACEAE

1. COLEOSPORIUM IPOMOEAE (Schw.) Burr. (on *Convolvulaceae*)

Ipomoea purga Hayne, Orotina, Dec. 30, 1915, II, iii, *320*.
Ipomoea sp., San José, Jan. 3, 1916, II, *358*.

The species was also detected in the phanerogamic herbarium of the New York Botanical Garden, showing an abundance of uredinia and telia on *Pharbitis hederacea* (L.) Choisy (*I. hederacea* Roth.) collected at San José, January 1896, A. Tonduz *7090*. The aecia occur on pine leaves, but have not been collected outside of the United States.

2. COLEOSPORIUM VIBURNI Arth. (on *Caprifoliaceae*)

Viburnum sp., Volcán de Irazú, Jan. 21, 1916, II, *451*.

A very local species, rarely collected, extending northward as far as Wisconsin. The aecia have not yet been detected.

3. COLEOSPORIUM ELEPHANTOPODIS (Schw.) Thüm. (on *Carduaceae*)

Elephantopus hypomalacus Blake, Orotina, Dec. 29, 1915, II, *314*.

A common rust, whose aecia are unknown.

4. COLEOSPORIUM EUPATORII Arth. (on *Carduaceae*)

Eupatorium collinum DC., San José, Dec. 28, 1915, II, *311*.
Eupatorium Oerstedianum Benth., San José, Dec. 10, 1915, II, *236*, same, Jan. 3, 1916, II, *354*; San Ramón, Jan. 12, 1916, II, *412*.

A somewhat common species of Central America and the West Indies. The aecia are unknown.

5. COLEOSPORIUM VERBESINAE Diet. & Holw. (on *Carduaceae*)

Verbesina myriocephala Sch. Bip., San Ramón, Jan. 13, 1916, II, *415*.

The species was also collected on *Verbesina nicaraguensis* Benth., at San José in 1911, and again at San Francisco de Guadelupe, Nov. 3, 1912, both by A. Tonduz, and both showing abundance of uredinia. The latter collection was distributed in Sydow, Fungi exotici exsiccati *115*. Aecia are not known.

Family: UREDINACEAE (MELAMPSORACEAE)

6. CHRYSOCELIS LUPINI Lagerh. & Diet. (on *Fabaceae*)

Lupinus Clarkei Oerst., Volcán de Irazú near Cartago, Jan. 21, 1916, I, *454*.

In most South American collections of this rust there are telia associated with the aecia. The aecial stage on the same host was also collected by E. Bethel, in about the same locality at 10,000 feet elevation, March 15, 1913, and also without trace of telia. This is the first report of the rust in North America.

7. CEROTELIUM FICI (Cast.) Arth. (on *Artocarpaceae*)

Ficus sp., San José, Dec. 10, 1915, II, *237½*, *238*.

A cosmopolitan rust of warm regions, but only uredinia have been found in America.

8. PHAKOPSORA VITIS (Thüm.) Syd. (on *Vitaceae*)

Vitis sp.

This widely distributed rust, especially on cultivated grapes, was collected in the uredinial stage on a cultivated grape at San

José, by A. Tonduz, date not given. A specimen was communicated by N. Patouillard.

9. SPIRECHINA RUBI (Diet. & Holw.) Arth. (on *Rosaceae*)

Rubus trichomallus Schlecht., San José, Dec. 11, 1915, II_1, ii_2, *254*.

A very abundant species of Guatemala and Mexico, possessing pycnia, uredinia and telia.

10. SPIRECHINA LOESENERIANA (P. Henn.) Arth. (on *Rosaceae*)

Rubus trichomallus Schlecht., above El Alto near Cartago, Jan. 16, 1916, II_1, III, *435*.

A long-cycle species, similar to *S. Rubi*, found chiefly in South America, and heretofore only once reported for North America, that being from Guatemala, collected in 1896.

11. SPIRECHINA PITTIERIANA (P. Henn.) Arth. (on *Rosaceae*)

Rubus adenotrichos Schlecht., slopes of Irazú above Cartago, Dec. 23, 1915, O, II_1, *285*.

Rubus sp., on road to Fraijanes, Volcán de Poás, Jan. 6, 1916, O, II_1, III, *380*; San José, Jan. 8, 1916, O, II_1, III, *393*.

This rust was first described as *Uromyces Pittierianus* P. Henn., and at the same place (Hedw. Beibl. 41: 101. 1902) the uredinia were called *Uredo ochraceo-flavus* P. Henn., both names being founded on a collection by A. Tonduz, made at Hacienda Belmira near Santa María de Dota, January 1898, on *Rubus* sp., the host bearing the number 11615. Through the kindness of I. Urban, of the Bot. Museum of Berlin, I have been able to examine a portion of both types. By my suggestion Dr. Urban secured the determination of the host, Dr. W. O. Focke pronouncing it to be *R. adenotrichos*.

12. CRONARTIUM COLEOSPORIOIDES (Diet. & Holw.) Arth. (on *Scrophulariaceae*)

Castilleja tenuiflora Benth. (?) Volcán de Irazú, Jan. 21, 1916, II, iii, *452*.

A common rust throughout the mountainous region of western North America. It has its aecia on twigs and trunks of pine, but they have not yet been taken in Mexico or Central America.

13. CRONARTIUM WILSONIANUM Arth. (on *Vitaceae*)

Cissus rhombifolia Vahl (?), slopes of Irazú above Cartago, Dec. 23, 1915, II, *286*; Orotina, Dec. 30, 1915, III, *323*; same, Dec. 31, 1915, II, *345*.

A long-cycle rust, heretofore known only from Cuba. The alternate form is still undetected. The specific determination of the host for each of the three collections is very uncertain.

14. CIONOTHRIX PRAELONGA (Wint.) Arth. (on *Carduaceae*)

Eupatorium daleoides (DC.) Hemsl., Trail to Volcán de Poás, Jan. 5, 1916, *367*; Cartago, Jan. 20, 1916, *448a*.

Eupatorium odoratum L., Orotina, Dec. 30, 1915, *321*.

Eupatorium sp., San José, Dec. 27, 1915, *306*.

This short-cycle rust was also detected in the phanerogamic herbarium of the N. Y. Bot. Garden, on *E. daleoides* Hemsl., Forets du Copey, February 1898, Tonduz *11679*.

15. ALVEOLARIA CORDIAE Lagerh. (on *Ehretiaceae*)

Cordia ferruginea R. & S., San Ramón, Jan. 13, 1916, *414*.

A peculiar, short-cycle rust, occurring also in Guatemala and the West Indies, as well as in South America. The host is a new one.

Family: AECIDIACEAE (PUCCINIACEAE)

16. RAVENELIA INGAE (P. Henn.) Arth. (on *Mimosaceae*)

Inga leptopoda Benth., San José, Jan. 8, 1916, O, II_1, II_2, *389*; same, Jan. 10, 1916, O, II_1, *400*; Tres Rios near San José, Jan. 17, 1916, II_2, *436*.

Inga sp., San José, Dec. 26, 1915, O, II_1, *295*.

A common rust on many species of *Inga* in tropical America, and like all species of the genus doubtless possesses pycnia, uredinia, and telia, although the telia have not yet been seen.

17. RAVENELIA MIMOSAE-ALBIDAE Diet. (on *Mimosaceae*)

Mimosa albida H.B.K., San José, Dec. 27, 1915, II_2, *302*.

The species is also known from Guatemala and Mexico.

18. **Ravenelia ectypa** Arthur & Holway sp. nov. (on *Mimosaceae*)

Calliandra gracilis Klotsch, San José, Dec. 26, 1915, II, III, *296*.

Uredinia amphigenous, scattered or somewhat grouped, round, 0.5–1 mm. across, early naked, subcuticular, pulverulent, cinnamon-brown, ruptured cuticle evident; paraphyses none; urediniospores broadly ellipsoid or obovoid, 17–19 by 19–26 μ; wall golden-brown, uniformly thin, 1 μ, moderately echinulate, the pores 6 or 7, scattered.

Telia amphigenous, scattered, round, 0.4–1 mm. across, early naked, subcuticular, dark chestnut-brown, ruptured cuticle evident; teliospore-heads hemispherical, usually consisting of four central and six marginal spores, 42–60 μ in diameter, each spore bearing 4–12 light brown spines, 3–5 μ long; cysts attached to the lower side of the marginal spores.

This species approaches *R. echinata* Lagerh. & Diet., but has larger urediniospores and smaller teliospore-heads. In *R. echinata* the heads have 6 central and 8 marginal spores, while in this species there are 4 central and 6 marginal spores.

19. RAVENELIA HUMPHREYANA P. Henn. (on *Caesalpiniaceae*)

Poinciana pulcherrima L., Orotina, Dec. 30, 1915, II_2, *328*.

A common long-cycle rust of the West Indies, Guatemala and Mexico.

20. CALLIOSPORA DIPHYSAE Arth. (on *Fabaceae*)

Diphysa robinoides Benth., Heredia, Dec. 17, 1915, O, III, *270*; San José, Dec. 28, 1915, O, III, *310*.

Diphysa sp., Orotina, Dec. 31, 1915, O, III, *336*.

Heretofore this short-cycle rust has been known from Mexico and Guatemala.

21. PROSPODIUM APPENDICULATUM (Wint.) Arth. (on *Bignoniaceae*)

Stenolobium Stans (L.) D. Don (*Tecoma Stans* Juss.), San José, Dec. 28, 1915, III, *300*.

A common warm-region rust in America. Like other species of the genus, it possesses pycnia, uredinia and telia.

22. PROSPODIUM AMPHILOPHII (Diet. & Holw.) Arth. (on *Bignoniaceae*)

Pithecoctenium muricatum DC., San José, Dec. 26, 1915, II, III, *293B*; Orotina, Dec. 31, 1915, II, III, *334*.

The species has heretofore been known only from Mexico.

23. PROSPODIUM TUBERCULATUM (Speg.) Arth. (on *Verbenaceae*)

Lantana Camara L., Cartago, Dec. 22, 1915, II, *277*.

The species is known in the tropical parts of both North and South America.

24. PROSPODIUM LIPPIAE (Speg.) Arth. (on *Verbenaceae*)

Lippia myriocephala Schl. & Cham., road to Volcán de Poás, Jan. 5, 1916, II, III, *372*.

Lippia sp., San José, Jan. 3, 1916, II, III, *364*; San Ramón, Jan. 13, 1916, II, *417*.

The spores in this material are somewhat smaller and less strongly developed than usual. A common species in tropical America.

25. SPHENOSPORA PALLIDA (Wint.) Diet. (on *Smilaceae*)

Smilax sp., San José, Dec. 26, 1915, II, *291*.

An interesting rust, occurring also in South America, is now first reported for North America. The initial stage is unknown.

The genus *Sphenospora* was established by Dietel (Ber. Deut. Bot. Ges. **10**: 63. 1892) to include the *Diorchidium pallidum* Wint. (Grevillea **15**: 86. 1887). He speaks of the rust as on *Dioscorea*, although Winter in his original description, does not mention a name for the host, and neither is one mentioned in the later writings by Dietel (Engler & Prantl, Pfl. Fam. **1**^{1**}: 70. 1897) or by Sydow, who calls it *Puccinia sphenospora* Syd., the host being spoken of as an unknown climbing plant. So far as the writer knows only one collection has heretofore been known, that made near Sao Francisco, Brazil, by Ule *143*. The collec-

tion by Prof. Holway is quite ample, but no flowers or fruit were obtained. There seems little question, nevertheless, that the host is some species of *Smilax*.

26. UROMYCES ERAGROSTIDIS Tracy (on *Poaceae*)

Eragrostis limbata Fourn., Cartago, Dec. 14, 1915, II, iii, *255*; San Ramón, Jan. 13, 1916, II, *421*.

A rust of wide distribution in America, its aecia being unknown.

27. UROMYCES COMMELINAE (Speg.) Cooke (on *Commelinaceae*)

Commelina longicaulis Jacq. (*C. nudiflora* Auct. not L.), Heredia, Dec. 17, 1915, II, *261*.

A common long-cycle rust in warmer regions, which rarely produces telia, and whose initial stage is unknown.

28. UROMYCES CELOSIAE Diet. & Holw. (on *Amaranthaceae*)

Iresine calea (Ibanez) Standley, San José, Dec. 10, 1915, II, *237*; Tres Rios near San José, Jan. 17, 1916, II, III, *437*.

A long-cycle rust occurring also in Guatemala, Mexico, and Cuba, whose first stage is unknown.

29. UROMYCES APPENDICULATUS (Pers.) Fries (on *Fabaceae*)

Phaseolus truxillensis H.B.K., San José, Jan. 10, 1916, II, *397*.

This is a record of a new host for this cosmopolitan long-cycle rust. The species was also collected on a cultivated species of *Phaseolus* at Guadalupe near San José, Sept. 1908, II, and communicated by N. Patouillard, name of collector not given, but probably A. Tonduz.

30. UROMYCES MEXICANUS Diet. & Holw. (on *Fabaceae*)

Meibomia uncinata (DC.) Kuntze (*Desmodium uncinatum* DC.), San José, Jan. 18, 1916, II, III, *443*.

Meibomia sp., San José, Jan. 17, 1916, II, III, *439*.

A long-cycle species, the initial stage unknown, heretofore only reported from Mexico.

31. UROMYCES DECORATUS Syd. (on *Fabaceae*)

Crotalaria vitellina Ker., San José, Dec. 10, 1915, II, *246*; same, Jan. 11, 1916, II, *410*.

This long-cycle rust is now reported from America for the first time, having been previously known only from the East Indies. The uredinial sorus is applanate and nonparaphysate, being quite unlike that of *Phakopsora Crotalariae* (Diet.) Arth. The Costa Rican material compares exactly with Sydow, Uredineen *2151*, on *C. juncea* from India, the type collection, but in the specimen seen showing only uredinia. Telia have not been seen. There is an *Uredo Theresae* Neg. (Beih. Bot. Centr. **13**: 78. 1902), from Colombia, S. A., which may be the same, but no specimen has been seen and the description is inadequate for decision. There is also an *Aecidium crotalariicola* P. Henn. (Hedw. Beibl. **38**: 70. 1899), from Brazil, which may possibly have genetic connection with this species, but no sufficient present information is available.

32. UROMYCES INDIGOFERAE Diet. & Holw. (on *Fabaceae*)

Indigofera mucronata Spreng., Orotina, Dec. 30, 1915, II, *322*.

A long-cycle rust, whose initial stage is not known. It extends northward into Texas.

33. UROMYCES GUATEMALENSIS Vestergr. (on *Fabaceae*)

Bauhinia inermis Pers., Orotina, alt. 600 feet, Dec. 29, 1915, ii, III, *315*.

A collection on the same host, as well as the type collection of the species, with which this collection has been compared, came from Guatemala. The rust is a long-cycle one, whose initial stage is unknown.

34. UROMYCES COLOGANIAE Arth. (on *Fabaceae*)

Cologania pulchella H.B.K., San José, Dec. 10, 1915, II, *248*.

Cologania sp., Road to Fraijanes on Volcán de Poás, Jan. 6, 1916, II, *381*.

A long-cycle species reported from Mexico, Guatemala, and Porto Rico. The initial stage in the life cycle is unknown.

35. UROMYCES PROËMINENS (DC.) Pass. (on *Euphorbiaceae*)

Chamaesyce hypericifolia (L.) Millsp., Orotina, Dec. 29, 1915, II, III, *319*.

Chamaesyce sp., Alajuela, Jan. 7, 1916, II, III, *384*.

An autoecious, long-cycle rust, widely distributed over the earth, and quite variable in morphological characters.

36. UROMYCES MYRSINES Diet. (on *Myrsinaceae*)

Ardisia compressa H.B.K., south of Cartago, Dec. 22, 1915, III, *280*.

A short-cycle rust of distinctive gross appearance, known on species of *Myrsine* from Bolivia and Brazil. This is the first record for North America. It is quite possible that *Uromyces marginatus* Bomm. & Rouss. (Bull. Soc. Bot. Belg. for 1896, page 156) may be synonymous with this species. It was described on an undetermined subcoriaceous leaf from Costa Rica, of which no material has been seen by the writer.

37. **Uromyces maculans** (Pat.) comb. nov. (on *Solanaceae*)

Cestrum nocturnum L.

The present record is founded on a collection made at Guadelupe near San José, March, 1909, by A. Tonduz, and communicated to the writer by N. Patouillard. It was on this collection that Patouillard founded the name *U. Cestri* var. *maculans* Pat. (Bull. Soc. Myc. Fr. 28: 140. 1912). It differs from *U. Cestri* in the more globoid and somewhat smaller aeciospores, as well as in the much thinner-walled teliospores. *Uromyces venustus* Diet. & Holw., of Mexico, has a rostrate teliospore, while *U. cestricola* Speg., of South America, has the peridial cells so finely verrucose as to appear smooth. From the three forms on *Cestrum* already recognized as species, this one appears abundantly different, and worthy of specific recognition. All of them are aeciogyrinious, and produce no urediniospores. They may be thus distinguished:

Telia
- Teliospores rostrate .... *U. venustus*
- Teliospores rounded or obtuse
  - Teliospore-wall thin (1.5–2.5 μ) .... *U. maculans*
  - Teliospore-wall thick (2.5–5 μ)
    - Teliospores largely ellipsoid .... *U. Cestri*
    - Teliospores largely globoid .... *U. cestricola*

Aecia	Aeciospores largely globoid (18–26 by 24–29 μ)	
	Peridial cells long (48–67 μ)	*U. venustus*
	Peridial cells short (24–42 μ)	*U. maculans*
	Aeciospores largely oblong (19–26 by 25–37 μ)	
	Peridial cells distinctly verrucose	*U. Cestri*
	Peridial cells appearing smooth	*U. cestricola*

38. **Uromyces Hariotanus** Lagerh. sp. nov. (on *Acanthaceae*)

Thyrsacanthus strictus Nees (?), San Ramón, Jan. 13, 1916, III, *416*; Tres Rios near Cartago, Jan. 17, 1916, III, *440*.

These collections agree exactly, even to the appearance of the host, with a collection made by G. von Lagerheim, on Acanthaceae, obtained at Guamampata, Prov. Chimborazo, Ecuador, August, 1891, and distributed by the collector under the name of "*Uromyces Hariotanus* Lagerh. n. sp." The name does not appear to have been published. A description is therefore appended, using the Ecuadorian collection as the type, and retaining the name, given by the collector in honor of the distinguished mycologist of the Museum of Natural History, Paris, recently deceased.

Telia amphigenous, numerous, scattered, or sometimes crowded, usually round, 0.2–1 mm. across, early naked, pulverulent, chocolate-brown, ruptured epidermis evident; teliospores ellipsoid, 19–21 by 26–32 μ, rounded or obtuse at both ends; wall dark cinnamon-brown, thick, 3–4 μ, thickened into a light brown or colorless umbo at apex, 6–9 μ, closely to moderately and noticeably verrucose; pedicel colorless, one and a half times length of spore, fragile.

39. UROMYCES HELLERIANUS Arth. (on *Cucurbitaceae*)

Cayaponia attenuata Cogn., San José, Jan. 10, 1916, ii, III, *399*.

A long-cycle species, not uncommon in tropical North America, of which the initial stage is unknown.

40. **Uromyces pressus** Arthur & Holway sp. nov. (on *Carduaceae*)

Vernonia Deppeana Less., San José, Jan. 3, 1916, II, iii, *361* (type); El Alto near Cartago, Jan. 16, 1916, II, *432*; Cartago, Jan. 20, 1916, II, *450*.

Vernonia sp., San Ramón, Jan. 13, 1916, II, III, *413*.

Pycnia epiphyllous, inconspicuous, subepidermal, globoid, 110 μ in diameter; ostiolar filaments present.

Uredinia amphigenous, gregarious on discolored spots 1–3 mm. in diameter, oval or oblong, 0.2–0.4 mm. long, early naked, pulverulent, yellowish-brown, ruptured epidermis conspicuous; urediniospores obovoid or globoid, 23–26 by 26–32 μ; wall yellowish- or pale cinnamon-brown, thick, 2.5–3.5 μ, moderately and rather coarsely echinulate, the pores 3, approximately equatorial.

Telia amphigenous, scattered, oval or oblong, 0.2–0.3 mm. long, early naked, white, ruptured epidermis usually inconspicuous; teliospores oblong-ellipsoid, or fusiform-ellipsoid, 16–18 by 29–35 μ, rounded or somewhat narrowed at both ends; wall colorless, uniformly very thin, 0.5 μ, smooth; pedicel colorless, about one half length of spore.

The pycnia were found sparingly on a specimen collected at Guagas, Ecuador, on *Vernonia* sp., December 1890, *G. Lagerheim*. The telia are very inconspicuous, due to their lack of color and early germination *in situ*.

41. UROMYCES COLUMBIANUS Mayor (on *Carduaceae*)

Melanthera aspera (Jacq.) Steud., Orotina, Dec. 29, 1915, II, iii, *318*; San José, Jan. 8, 1916, O, I, II, *386*.

Melanthera sp., Trail to Volcán de Poás, Jan. 5, 1916, I, II, III, *371*; San Ramón, Jan. 14, 1916, II, *428*.

A long-cycle rust common on species of *Melanthera* in tropical America, including the West Indies.

42. UROMYCES BIDENTICOLA (P. Henn.) Arth. (on *Carduaceae*)

Bidens tereticaulis antiguensis (Coult.) O. E. Schultz, Volcán de Irazú, Jan. 21, 1916, O, II_1, *453*.

Bidens sp., Trail to Volcán de Poás, Jan. 5, 1916, O, II_1, *370*.

These collections show pycnia and primary uredinia. The status of the name is given in Mycologia 9: 71. 1917.

43. UROMYCES BIDENTIS Lagerh. (on *Carduaceae*)

Bidens sp., San José, Jan. 8, 1916, *391* (with some leaves bearing *U. bidenticola* (P. Henn.) Arth.)

This correlated, short-cycle species is frequently associated with the preceding long-cycle species, and has about the same range.

44. **Uromyces Montanoae** Arthur & Holway sp. nov. (on *Carduaceae*)

Montanoa dumicola Klatt., San José, Dec. 11, 1915, II, III, *251*; same, Jan. 18, 1916, II, *444*; Tres Rios near San José, Dec. 20, 1915, II, *273*.

Montanoa sp., San José, Jan. 3, 1916, II, *355*; San Ramón, Jan. 14, 1916, II, *427*.

Uredinia hypophyllous, scattered, round or oblong, 0.1–1 mm. across, early naked, pulverulent, cinnamon- or light chestnut-brown, ruptured epidermis evident; urediniospores when viewed with pores in optical section obovoid-triangular, 23–24 by 23–28 μ, with pores in central part obovoid or ellipsoid, narrower, 19–23 by 23–28 μ; wall cinnamon-brown, thin, 1–1.5 μ, moderately echinulate, the pores 2, equatorial.

Telia hypophyllous, scattered, round, 0.3–0.5 mm. across, early naked, compact, dark cinnamon-brown, becoming cinereous from germination, ruptured epidermis inconspicuous; teliospores narrowly obovoid or ovoid, 18–21 by 29–40 μ, rounded at both ends or narrowed below; wall cinnamon-brown, thin, 1 μ, much thicker above, 4–7 μ, smooth; pedicel colorless or yellowish, as long as or shorter than the spore.

The species much resembles *Uromyces bidenticola,* but differs in having urediniospores with thinner walls, equatorial pores, and triangular form in certain positions. The teliospores often germinate at maturity, even in evident genetic connection with the uredinia. It is possible the same thing may occur in *U. bidenticola.*

The type for the species is a collection made by Professor Holway on *Montanoa Pittieri* Robs. & Greenm., in Guatemala, at San Lucas Toliman, 5100 feet alt., Dept. Solola, Feb. 2, 1915, II, III, *176*.

45. UROMYCES CUCULLATUS Sydow (on *Carduaceae*)

Zexmenia aurantiaca Klatt.

The species, which is common in Mexico on a variety of hosts, was founded on a Costa Rican specimen sent to Sydow by Neger, which appears to have been taken from a phanerogamic collection made by A. Tonduz at Rio Visilla, Prov. San José, alt. 1,100 meters, represented in the herbarium Nat. Cost. *9836*. A speci-

men in the Field Museum, Chicago, numbered *76850*, appears to be part of the original Tonduz collection, and from this specimen, which shows well-developed telia, was taken the mycological material on which this entry is based.

46. PUCCINIA DOCHMIA Berk & Curt. (on *Poaceae*)

Muhlenbergia tenella (H.B.K.) Trin., Cartago, Dec. 14, 1915, II, III, *256*; San José, Dec. 27, 1915, ii, III, *304*; same, Jan. 11, 1916, ii, III, *408*.

This heteroecious rust, whose aecia are not known, was also collected on the same host in the telial stage, at San Juan, by H. Polakowsky, Dec. 1, 1875.

47. PUCCINIA CENCHRI Diet. & Holw. (on *Poaceae*)

Cenchrus echinatus L., Orotina, Dec. 31, 1915, II, *342*.

A heteroecious rust, common in the warmer parts of America, whose aecia are unknown.

48. **Puccinia venustula** (Arth.) comb. nov. (on *Poaceae*)

Andropogon brevifolius Sw., Orotina, Dec. 29, 1915, II, III, *317*.

Heretofore only one collection of this species has been known, the type collection for *Uredo venustula* Arth., on the same host, made by Prof. F. L. Stevens in Porto Rico (Mycol. **8**: 21. 1916). The present collection shows abundance of telia in addition to the uredinia. The telial stage may be thus characterized.

Telia chiefly hypophyllous, scattered, oblong to linear, 0.2–1.0 mm. long, early naked, compact, blackish, ruptured epidermis evident, teliospores clavate or ellipsoid, 19–23 by 39–50 μ, rounded at both ends, or narrowed below; wall chestnut-brown below, chocolate-brown above, 2–3 μ, thickened above, 9–10 μ, smooth; pedicel short, chestnut-brown.

49. PUCCINIA PURPUREA Cooke (on *Poaceae*)

Sorghum sp. (cultivated).

A specimen of this rust was communicated by N. Patouillard, collected by A. Tonduz at Guadalupe, October, 1908, showing much parasitized uredinia. It is common and abundant on the cultivated sorghums in the tropics of both hemispheres.

50. PUCCINIA CANALICULATA (Schw.) Farl. (on *Cyperaceae*)

Cyperus ferax L. C. Rich., San José, Jan. 8, 1916, II, *385*.

Dichromena radicans Schl. & Cham., San Ramón, Jan. 13, 1916, II, *420*.

A widespread heteroecious rust, usually only producing uredinia in the warmer regions.

51. **Puccinia consobrina** Arthur & Holway sp. nov. (on *Cyperaceae*)

Rynchospora polyphylla Vahl, San Ramón, Jan. 14, 1916, II, III, *430*.

II. Uredinia hypophyllous, scattered, oblong, 0.2–0.4 mm. long, soon naked, cinnamon-brown, ruptured epidermis noticeable; urediniospores globoid or ellipsoid, 18–23 by 21–26 μ; wall cinnamon-brown, 1.5–2.5 μ, moderately echinulate, the pores 2, equatorial.

III. Telia hypophyllous, scattered, ellipsoid, small, 0.1–0.2 mm. long, soon naked, chestnut-brown, ruptured epidermis inconspicuous; teliospores ellipsoid or oblong, 19–23 by 32–37 μ, rounded at both ends, somewhat constricted at septum; wall chestnut-brown, 2–3 μ thick, somewhat thicker above, about 7 μ including a lighter umbo; pedicel colorless, once to twice length of spore.

The species differs widely in its ellipsoid teliospores from *P. angustatoides* Stone, with its cuneate teliospores and occurring on various species of *Rynchospora* in the southeastern United States and the West Indies. The urediniospores also show differences in size and position of pores.

The rust occurs on the same host on a specimen in the phanerogamic herbarium of the N. Y. Bot. Garden, collected at Content Gap, vicinity of Cinchona, Jamaica, W. I., Sept. 2–10, 1906, II, III, *N. L. Britton 33*. Another collection from Jamaica has also been found in the cryptogamic collection of the same institution, on *R. corymbosa* (L.) Britton, road between Port Antonio and St. Margaret's Bay, March 28, 1913, II, *L. M. Underwood 1715*.

52. **Puccinia Pallor** Arthur & Holway sp. nov. (on *Amaryllidaceae*)

Bomaria sp., Volcán de Irazú, Cartago, Dec. 23, 1915, II, *287*.

Pycnia amphigenous, crowded in small groups, noticeable, subepidermal, globoid or slightly flattened, 96–160 μ in diameter.

Aecia amphigenous surrounding the pycnia, rather inconspicuous, 0.2–0.4 mm. in diameter, deep-seated, over-arched by two or more layers of host cells which tardily rupture by a short slit or pore; peridium wanting, but sometimes replaced by a thin layer of mycelium; aeciospores globoid to broadly ellipsoid, 18–23 by 19–24 μ; wall colorless, thin, 1–1.5 μ, closely and finely verrucose.

Uredinia hypophyllous, scattered, oval or oblong, 0.4–1 mm. long, rather tardily naked, at first opening by a slit or pore, pulverulent, yellowish, ruptured epidermis conspicuous; urediniospores broadly ellipsoid or obovoid, 18–21 by 23–28 μ; wall colorless, thin, 1–1.5 μ, finely and closely echinulate, the pores obscure.

Telia hypophyllous, scattered, oval or oblong, 0.3–0.8 mm. long, rather early naked, somewhat pulverulent, white, ruptured epidermis evident; teliospores oblong to fusiform-oblong, 16–23 by 42–64 μ, rounded or acute at both ends, or sometimes narrowed below, slightly constricted at septum, germinating at maturity; wall colorless, thin, 1 μ, sometimes thickened at apex or side, 3–4 μ, smooth; pedicel colorless, somewhat fragile, half length of spore or less.

A very distinct species with *Eriosporangium*-like characters, the first such species to be found on monocotyledonous hosts. The aecia are easily overlooked. The type selected is a collection on *B. acutifolia* Herb. made by Professor Holway in Guatemala, Volcán de Agua, Dept. Sacatepéquez, March 7, 1916, O, I, II, III, *562*.

53. PUCCINIA POLYGONI-AMPHIBII Pers. (on *Polygonaceae*)

Persicaria punctata (Ell.) Small (*Polygonum punctatum* Ell.), San José, Jan. 8, 1916, II, *395*.

A widespread species, only forming uredinia as a rule in the tropics.

54. **Puccinia detonsa** Arthur & Holway sp. nov. (on *Caryophyllaceae*)

Stellaria ovata Willd., San José, Dec. 11, 1915, *252*.

Telia hypophyllous and caulicolous, more or less confluent in round or elongate masses 1–2 mm. across on indefinite discolored

areas, or sometimes scattered, round, 0.3–0.6 mm. in diameter, early naked, pulvinate, light yellowish-brown, ruptured epidermis inconspicuous; teliospores oblong or fusiform-oblong, 12–15 by 30–40 μ, rounded or acute at apex, more or less narrowed below, somewhat constricted at septum; wall pale golden-brown, very thin, 1 μ or less, not or a little thickened above, up to 3 μ, smooth; pedicel colorless, about as long as the spore.

This short-cycle species differs from *Puccinia Arenariae* (Schum.) Wint. especially in the pale and very thin-walled spores.

55. PUCCINIA ARECHAVELATAE Speg. (on *Sapindaceae*)

Cardiospermum grandiflorum Sw., Alajuela, Jan. 7, 1916, *383*.

A short-cycle rust, common throughout the American tropics.

56. PUCCINIA GOUANIAE Holw. (on *Frangulaceae*)

Gouania polygama (Jacq.) Urban (*G. tomentosa* Jacq.), San José, Dec. 26, 1915, II, *293A*; Orotina, Dec. 31, 1915, II, *333*.

A species having pycnia, primary and secondary uredinia, and telia. It occurs also in the West Indies, and in Panama.

57. PUCCINIA HETEROSPORA Berk. & Curt. (on *Malvaceae*)

Malvaviscus arboreus Cav., Cartago, Dec. 22, 1915, *276*; San José, Jan. 10, 1916, *402*.

A short-cycle rust, widely distributed in both North and South America on many hosts.

58. PUCCINIA ANODAE Syd. (on *Malvaceae*)

Anoda hastata Cav., Cartago, Dec. 14, 1915, *257*.

The species is known from South America, but has not before been reported from North America. It was, however, collected by Prof. Holway in Mexico, on *Anoda acerifolia* Cav., intermixed with his no. 3194 of *P. heterospora*. It is a short-cycle rust, with cinnamon-brown sori and teliospores.

59. **Puccinia filopes** Arthur & Holway sp. nov. (on *Sterculiaceae*)

Buettneria carthaginensis Jacq., Orotina, Dec. 31, 1915, *337*.

Telia chiefly hypophyllous, crowded or confluent in circular areas 2–5 mm. across on larger discolored spots, round, 0.1–0.3

mm. in diameter, early naked, pulvinate, golden-brown, becoming cinereous by germination, ruptured epidermis inconspicuous; teliospores oblong-obovoid, 13–16 by 30–40 μ, rounded above, somewhat narrowed below, slightly constricted at septum; wall pale golden-brown, sometimes lighter below, 1–1.5 μ thick, slightly or not thickened at apex; pedicel colorless, once to twice length of spore, slender, 7–9 μ in diameter next to spore, tapering downward.

A short-cycle rust, probably without pycnia, for which the type selected was collected by Professor Holway in Guatemala, on *Buettneria lateralis* Presl, at Escuintla, Feb. 17, 1916, *501*.

60. PUCCINIA VIOLAE (Schum.) DC. (on *Violaceae*)

Viola nannei Polak, Volcán de Irazú, Cartago, Dec. 23, 1915, II, III, *289*; El Alto near Cartago, Jan. 16, 1916, II, III, *433*.

A widespread, long-cycle species, with aecia, much more abundant in temperate regions.

61. PUCCINIA FUCHSIAE Syd. & Holw. (on *Onagraceae*)

Lopezia hirsuta Jacq., Volcán de Irazú, Cartago, Dec. 23, 1915, *282*; Tres Rios near San José, Jan. 17, 1916, *438*.

A short-cycle rust found on the same host in Guatemala and extending to southern Mexico on Fuchsia.

62. PUCCINIA FUMOSA Holw. (on *Polemoniaceae*)

Loeselia sp., San José, Dec. 26, 1915, II, iii, without number.

A long-cycle rust with all spore forms, known from Mexico and Guatemala.

63. PUCCINIA HYDROCOTYLES (Link) Cooke (on *Ammiaceae*)

Hydrocotyle umbellata L., San José, Dec. 15, 1915, II, *259*.

The species was also collected on *H. mexicana* Cham. & Schl., at San José, by A. Tonduz, August, 1908, showing uredinia.

It is a long-cycle rust whose initial stage is yet unknown, unless the form described by Spegazzini as *Aecidiolum Hydrocotyles* may belong here. It is common in the warmer parts of America, and less common in other parts of the world.

64. PUCCINIA CRASSIPES Berk. & Curt. (on *Convolvulaceae*)

Ipomoea purga Hayne, Orotina, Dec. 30, 1915, I, III, *325*; San José, Jan. 8, 1916, I, *392*; Heredia, Jan. 23, 1916, I, *456*.

The rust was also collected at a small railway station about fifty miles west of Limón, on *I. trifida* (H.B.K.) G. Don, by E. Bethel, March, 1913, showing aecia only. The species is common in tropical America.

65. PUCCINIA LANTANAE Farl. (on *Verbenaceae*)

Lantana Camara L., San José, Dec. 27, 1915, *303*; same, Jan. 3, 1916, *352*.

Lantana hispida H.B.K., San José, Dec. 10, 1915, *244*; Cartago, Dec. 22, 1915, *278*.

Lantana sp., Orotina, Dec. 31, 1915, *338*.

A short-cycle rust common in the warmer parts of America.

66. **Puccinia elatipes** Arthur & Holway sp. nov. (on *Verbenaceae*)

Lippia sp., hills southwest of San José, Dec. 27, 1915, II, III, *307*.

Pycnia epiphyllous, few, crowded on discolored spots, 1–1.5 mm. across, conspicuous, subepidermal, cinnamon-brown or darker, flattened conical, 190–238 μ broad by 74–144 μ high.

Uredinia amphigenous, crowded on spots with the pycnia, round or oval, 0.2–0.4 mm. across, early naked, pulverulent, cinnamon-brown, ruptured epidermis inconspicuous; urediniospores obovoid, usually flattened above and on the pore-bearing sides, so that when seen with pores in optical section appearing obovoid-triangular, 23–25 by 26–29 μ in obovoid view, and 26–29 by 26–29 μ in triangular view; wall cinnamon-brown, 1.5 μ thick, rather sparsely and strongly echinulate, the pores 2, approximately equatorial.

Telia hypophyllous or somewhat amphigenous, scattered, round, 0.1–0.5 mm. across, early naked, pulvinate, chestnut-brown, ruptured epidermis inconspicuous; teliospores ellipsoid, 23–26 by 39–42 μ, rounded at both ends, moderately constricted at the septum; wall cinnamon-brown, thin, 1 μ, thickened by a colorless umbo at the apex, 3–4 μ, smooth; pedicel colorless, cylindric or fusiform-cylindric, 18–24 by 100–150 μ, the wall thin.

The species is especially characterized by flattened urediniospores and by exceedingly large and inflated pedicels to the teliospores. The type was collected by Professor Holway in Guatemala on *Lippia myriocephala* Schl. & Cham., on the road between Quezaltenango and Colomba, Feb. 4, 1917, O, ii, III, *831*. The host of the Costa Rican collection resembles *L. umbellata* Cav.

67. PUCCINIA URBANIANA P. Henn. (on *Verbenaceae*)

Valerianodes cayennensis (Vahl) Kuntze (*Stachytarpheta cayennensis* Vahl), Orotina, Dec. 31, 1915, *335*.

A short-cycle rust, very common in tropical America on many hosts.

68. **Puccinia permagna** Arthur & Holway sp. nov. (on *Verbenaceae*)

Lippia myriocephala Schl. & Cham., San José, Jan. 10, 1916, *404*.

Pycnia epiphyllous, loosely grouped on yellowish spots 0.4–1.5 mm. across, noticeable, blackish-brown, subepidermal, conoidal, 112–128 μ broad, 55–80 μ high; ostiolar filaments wanting.

Telia mostly hypophyllous, numerous, single or crowded into irregular groups, roundish, large, 1–2.5 mm. across, somewhat pulvinate, cinnamon-brown, ruptured epidermis inconspicuous; teliospores broadly ellipsoid, 24–27 by 35–42 μ, rounded at both ends, slightly constricted at septum; wall cinnamon-brown, thin, 1 μ, thicker above and over pore near septum, 3–6 μ, forming a hyaline umbo, smooth; pedicel very large and inflated, 20–25 μ in diameter, often somewhat fusiform, four to five times length of spore, the wall colorless, thin, 1 μ, usually thickened next the spore.

The species has a general resemblance to *P. elatipes* Arth. & Holw., which occurs on the same host in Guatemala, but is without uredinia. The pycnia are remarkably numerous and conspicuous, being much darker than in *P. elatipes*. The telial sori are also larger than in that species, as are the teliospores and especially their pedicels.

The fungus was found only on fresh shoots coming up from stumps of the shrubs cut to make the trail. The growth was very

luxuriant and the leaves much larger than on shoots of slower growth. Such preference seems to be common for rusts on shrubs and trees.

69. PUCCINIA MITRATA Sydow (on *Lamiaceae*)

Salvia polystachya Ort., San José, Jan. 3, 1916, ii, III, *348*.

The species occurs also in Guatemala and southern Mexico. The present collection, the only one known from Costa Rica, has the characteristic, thick-walled teliospores of the species, which is a close relative of *P. farinacea*. The beginning stages in the life cycle are not known.

70. **Puccinia impedita** Mains & Holway sp. nov. (on *Lamiaceae*)

Salvia hyptoidis Mart. & Gal., Heredia, Dec. 17, 1915, II, *264*; San José, Dec. 26, 1915, II, III, *297* (type); Orotina, Dec. 31, 1915, II, *340*.

Salvia occidentalis Sw., Orotina, Dec. 30, 1915, II, *326*.

Salvia tiliaefolia Vahl, Tres Rios near San José, Jan. 17, 1916, II, iii, *441*.

Uredinia hypophyllous, scattered, round, 0.1–0.5 mm. across, early naked, pulverulent, cinnamon-brown, ruptured epidermis evident; urediniospores oblate-sphaeroid, 18–23 μ broad by 16–19 μ long, or globoid, 16–23 μ in diameter; wall cinnamon-brown, 1–1.5 μ thick, moderately echinulate, the pores 2–3, approximately equatorial or slightly subequatorial.

Telia hypophyllous or caulicolous, scattered, on the leaves round, 0.2–0.4 mm. in diameter, on the stems crowded or coalescent, 2–12 mm. in length, early naked, pulvinate at first, becoming pulverulent, blackish-brown, ruptured epidermis inconspicuous; teliospores broadly ellipsoid, 24–32 by 30–50 μ, rounded at both ends, not constricted at septum; wall dark chestnut-brown, thick, 3–5 μ, thicker over germ pore as a yellowish umbo, 5–9 μ, very finely and inconspicuously verrucose; pedicel long, two to three times length of spore, the wall usually firm and thick, 1.5–2.5 μ.

The species is related to *P. salviicola* Diet. & Holw., where it has heretofore been listed, but which is now believed to be a more northern form, not reaching to Central America. It also resembles *P. caulicola* Tracy & Gall., but the teliospores are con-

siderably broader and more nearly ellipsoid than in that species. Uredinia associated with pycnia were found on a collection from Porto Rico on *Salvia coccinea*, appearing like this species, but no teliospores were present to make the determination certain. The diagnoses for this and the following species were drawn up by E. B. Mains.

71. **Puccinia diutina** Mains & Holway sp. nov. (on *Lamiaceae*)

Salvia Pittieri Briq. (?), slopes of Volcán de Irazú above Cartago, Dec. 23, 1915, O, I, II, III, *290*.

Pycnia epiphyllous, few, noticeable, light brown, subepidermal, globoid, 100–190 μ in diameter.

Aecia hypophyllous, crowded on yellowish spots opposite the pycnia; peridium white, the margin erose; peridial cells irregularly rectangular in longitudinal section, 13–20 by 26–50 μ, abutted or slightly overlapping, the outer wall 5–13 μ thick, striate, the inner wall 1.5 μ, closely and finely verrucose; aeciospores ellipsoid or globoid, 19–26 by 27–39 μ; wall colorless, thick, 2.5–5 μ, very finely and closely verrucose.

Uredinia amphigenous, scattered, round, small, 0.1–0.2 mm. in diameter, early naked, pulverulent, dark cinnamon- or chestnut-brown, the ruptured epidermis rather inconspicuous; urediniospores oblate-spheroid or globoid, 19–24 μ in diameter; wall dark chestnut- or light cinnamon-brown above, 2 μ thick, becoming rather abruptly colorless and less than 1 μ thick below, closely and finely echinulate, the pores indistinct.

Telia amphigenous, scattered, round, 0.1–0.2 mm. across, early naked, somewhat pulverulent, blackish-brown, ruptured epidermis rather inconspicuous; teliospores broadly ellipsoid, 23–26 by 25–33 μ, rounded at both ends, slightly or not constricted at septum; wall dark chestnut-brown, 2–3 μ thick, occasionally thickened up to 5 μ above, rather closely and coarsely verrucose; pedicel colorless, fragile, once to twice length of spore, sometimes attached laterally.

The same species was also collected by Prof. Holway in Mexico on *Salvia scorodoniaefolia* Poir., at Chapala, Sept. 24, 1899, II, iii, *3493*, and at Oaxaca, Oct. 21, 1899, II, III, *3698*. In its teliospores it resembles *P. badia* somewhat, but in the other two spore forms the species is markedly distinct.

72. PUCCINIA HYPTIDIS (Curt.) Tracy & Earle (on *Lamiaceae*)

Hyptis capitata (L.) Jacq., San Ramón, Jan. 13, 1916, II, *419*.

A common rust of Mexico, West Indies, and the southern United States.

73. PUCCINIA HYPTIDIS-MUTABILIS Mayor (on *Lamiaceae*)

Hyptis polystachya H.B.K., Heredia, Dec. 17, 1915, I, II, III, *269*; Orotina, Jan. 1, 1916, I, II, iii, *346*; San José, Jan. 10, 1916, II, *405*.

This species is now first reported from North America. It was described from material collected in Colombia, S. A., only uredinia and telia being present. The Costa Rican material shows aecia, as well as the other forms, which may be thus characterized.

Aecia amphigenous, in crowded groups, 1–2.5 mm. across, round or nearly so, 0.2–0.5 mm. in diameter; peridium very fragile and evanescent, frequently less conspicuous than the ruptured epidermis; peridial cells irregularly cylindric, overlapping, the outer wall sometimes tinted, about 3 μ thick, smooth, the inner wall 3–4 μ thick, conspicuously verrucose; aeciospores ellipsoid or ovoid, 16–19 by 21–30 μ; wall light yellow, 1.5–2 μ thick, closely and noticeably verrucose.

74. PUCCINIA FIDELIS Arth. (on *Lamiaceae*)

Hyptis lilacina Schiede & Deppe, San José, Dec. 10, 1915, I, II, iii, *245*.

The species occurs on the same host also in Guatemala.

75. PUCCINIA MEDELLINENSIS Mayor (on *Lamiaceae*)

Hyptis pectinata Poir., San José, Dec. 26, 1915, I, II, III, *297½*.

Hyptis polystachya H.B.K., road to Volcán de Poás, Jan. 5, 1916, II, *373*.

Hyptis suaveolens Poir., Orotina, Dec. 29, 1915, II, *313*.

Hyptis sp., Orotina, Dec. 30, 1915, I, II, iii, *331*.

A common long-cycle rust in tropical America.

76. PUCCINIA SARACHAE Mayor (on *Solanaceae*)

Sarache jaltomata Schlecht., Volcán de Irazú, Cartago, Dec. 23, 1915, *282½*, *283*.

A short-cycle species, described from South America, and now reported for the first time from North America. The host is the *yerba mora,* common in the gardens of Costa Rica, and grown for its edible fruit. The plant much resembles large forms of *Solanum nigrum.*

77. PUCCINIA PITTIERIANA P. Henn. (on *Solanaceae*)

Solanum tuberosum L., Volcán de Irazú, 10,000 feet alt., Cartago, Jan. 21, 1916, *455.*

This short-cycle species, the only rust known on the common field potato, was first collected by H. Pittier, on Volcán de Irazú, September, 1903, and again at La Canada, probably at or near the original locality, in October 1904. It has not yet been reported outside the type vicinity.

78. PUCCINIA ACNISTI Arth. (on *Solanaceae*)

Acnistus arborescens Schl., San José, Dec. 10, 1915, I, *240*; Heredia, Dec. 17, 1915, O, I, *266*; road to Fraijanes, Volcán de Poás, Jan. 6, 1916, I, *376*; Cartago, Jan. 20, 1916, I, *449.*

A long-cycle species, having pycnia, aecia and telia, now first reported for North America. The type material came from the mountains of Peru, and on the same host.

79. **Puccinia nesodes** Arthur & Holway sp. nov. (on *Scrophulariaceae*)

Lamourouxia Gutierrezii Oerst., road to Fraijanes, Volcán de Poás, Jan. 6, 1916, *379*; San José, Jan. 11, 1916, *411.*

Lamourouxia viscosa H.B.K., Tres Rios near San José, Dec. 20, 1915, *275* (type).

Telia chiefly hypophyllous, more or less confluent in circular groups 1–6 mm. across, round, 0.1–0.5 mm. in diameter, early naked, pulvinate, chestnut-brown, becoming cinereous by germination, ruptured epidermis inconspicuous; teliospores obovoid or ellipsoid, 13–19 by 26–39 μ, rounded above, rounded or narrowed below, slightly constricted at septum; wall cinnamon-brown, thin, 1–2 μ, thicker above, 3–7 μ, smooth; pedicel colorless, once or twice length of spore.

This short-cycle species has resemblances to others on the

same family of plants, none of which, however, extends into Central America. It has smaller spores with less apical thickening than *P. mexicana* D. & H. on *Pentstemon*. In spore measurements it is like the northern *P. Synthyridis* E. & E., on *Synthyris,* but has darker and more crowded sori, while from *P. Seymeriae* Burr., on *Gerardia* and *Dasystoma* it is distinguished by darker and thicker-walled spores. The same species occurs in Guatemala on *Castilleja.*

80. **Puccinia depallens** Arthur & Holway sp. nov. (on *Bignoniaceae*)

Pithococtenium muricatum DC. (?), road to Volcán de Poás, Jan. 5, 1916, O, III, *365*.

Pycnia epiphyllous, gregarious on discolored areas 2–3 mm. across, light brown becoming dark brown, conspicuous, subcuticular, lenticular or low conic, 128–160 μ in diameter, 48–77 μ high; ostiolar filaments wanting; pycniospores ellipsoid, colorless, 2.5 by 3–4 μ.

Telia hypophyllous, crowded in circles on spots opposite the pycnia, early naked, oval, 0.2–0.4 mm. long, compact, light cinnamon-brown or cinereous from the germinating spores, ruptured epidermis inconspicuous; teliospores terete, large, 16–27 by 45–96 μ, obtuse or rounded at both ends, slightly or not constricted at the septum, which is more or less oblique; wall colorless or slightly tinted, uniformly thin, 1 μ, smooth; pedicel half to nearly as long as the spore, colorless, firm, broad, thin-walled.

A short-cycle rust with quite or nearly colorless teliospores, that germinate at maturity. It occurs also in Guatemala on the same host.

81. PUCCINIA RUELLIAE (B. & Br.) Lagerh. (on *Acanthaceae*)

Blechum Brownei (Sw.) Juss., San José, Jan. 17, 1916, II, *347*.

Justicia sp., Orotina, Dec. 29, 1915, II, *316*; Cartago, Jan. 20, 1916, I, *447*.

A long-cycle rust, cosmopolitan in milder climates, extending northward to the next to last tier of states before reaching the Canadian line in the Mississippi valley. The form on *Blechum* with which teliospores have only been found in Cuba and Ecuador, is usually listed under the name *P. Blechi* Lagerh., and forms

on other hosts are quite commonly given under *P. lateripes* Berk. & Rav. Considerable variation exists in the size of the spores, generally influenced by the succulency of the host.

82. PUCCINIA ELYTRARIAE P. Henn. (on *Acanthaceae*)

Tubiflora squamosa (Jacq.) Kuntze (*Elytraria squamosa* Lind.), Orotina, Dec. 29, 1915, *312*.

A short-cycle rust occurring also in Mexico and Guatemala, as well as in South America.

83. PUCCINIA LATERITIA Berk. & Curt. (on *Rubiaceae*)

Borreria ocymoides (Burm.) DC., San José, Dec. 11, 1915, *250*; same, Dec. 26, 1915, *299*.

Coccocypselum hirsutum Bartl., hills southwest of Cartago, Dec. 22, 1915, *279*.

A common short-cycle rust, found on many hosts. The second host named is new for the species.

84. PUCCINIA PUNCTATA Link (on *Rubiaceae*)

Galium uncinatum DC., slopes of Volcán de Irazú above Cartago, Dec. 23, 1915, II, *284*.

A common long-cycle rust, especially well developed in temperate regions.

85. PUCCINIA ROTUNDATA Diet. (on *Carduaceae*)

Vernonia patens H.B.K., Orotina, Jan. 1, 1916, O, III, *343*.

A short-cycle rust described from South America and now first reported from North America.

86. PUCCINIA DISCRETA Jacks. & Holw. (on *Carduaceae*)

Vernonia Deppeana Less., San José, Dec. 15, 1915, O, III, *260*; same, Dec. 27, 1915, O, III, *305*; same, Jan. 3, 1916, III, *363*; same, Jan. 10, 1916, III, *406*.

A short-cycle form found also in Guatemala, although the type of the species is no. 260, cited above. It is a microform, usually occurring on the leaves of terminal shoots from young plants.

87. PUCCINIA ARTHURIANA Jackson (on *Carduaceae*)

Vernonia canescens H.B.K., Volcán de Irazú, Cartago, Dec. 24, 1915, II, III, *281*; San José, Jan. 3, 1916, O. II, III, *360*.

The species is a long-cycle one, without aecia of the aecidioid form, and heretofore has only been known from the West Indies. It was published in the North American Flora (7:218. 1912) under the name *Argomyces Vernoniae* Arth., and so listed in the two reports on the Uredinales of Porto Rico (Mycol. 7:180. 1915; and 9:67. 1917), but in order to be uniform in placing white-spored forms under the genus *Puccinia*, it has been given another name in recent studies made by Jackson, as that of *P. Vernoniae* Schw., was already in use for another species.

88. PUCCINIA PRAEALTA Jacks. & Holw. (on *Carduaceae*)

Vernonia triflosculosa H.B.K., Heredia, Dec. 17, 1915, II, *262*; San José, Jan. 10, 1916, II, III, *407*; San Ramón, Jan. 13, 1916, II, *426*.

A long-cycle species, whose initial stage is not known. It occurs also in Guatemala on the same host. The sori are deep seated and strictly epiphyllous.

89. PUCCINIA IDONEA Jacks. & Holw. (on *Carduaceae*)

Vernonia triflosculosa H.B.K., San José, Jan. 8, 1916, II, III, *398*; same, Jan. 18, 1916, III, *445*.

The sori of this species, which occurs also in Guatemala, are chiefly hypophyllous. Aecia are not yet known.

90. PUCCINIA PAUPERCULA Arth. (on *Carduaceae*)

Elephantopus spicatus Juss., San José, Jan. 3, 1916, *353*.

A short-cycle species occurring also in Mexico and Guatemala. It was collected on the same host at San Francisco de Guadalupe, by A. Tonduz, July, 1908. This collection was made the basis of a new name, *P. Elephantopodis-spicati* Pat., and a part of the type material was kindly transmitted for study by the author of it, N. Patouillard. It is found to be identical with the older named species.

91. PUCCINIA CONOCLINI Seym. (on *Carduaceae*)

Eupatorium pycnocephalum Less., San José, Jan. 11, 1916, II, III, *409*.

Eupatorium Sinclairi Benth., Heredia, Dec. 17, 1915, II, *263*; Orotina, Dec. 30, 1915, II, *329*; trail to Volcán de Poás, Jan. 5, 1916, II, III, *375*.

A widespread species of tropical and temperate North America, whose initial stage is unknown.

92. **Puccinia inermis** Jackson & Holway sp. nov. (on *Carduaceae*)

Eupatorium sp., El Alto near Cartago, Jan. 16, 1916, II, iii, *434A*.

Uredinia hypophyllous, few, scattered, round, small, 0.2–0.4 mm. in diameter, early naked, dark cinnamon-brown, pulverulent, ruptured epidermis conspicuous; urediniospores greatly compressed laterally, somewhat flattened beneath, appearing somewhat reniform seen from the side with pores in optical section, 30–34 μ in greatest breadth from pore to pore, 24–26 μ broad at right angles, 23–26 μ long from hilum to apex; wall cinnamon-brown, 1–1.5 μ thick, finely and moderately echinulate, the pores 2, equatorial at the broadest part.

Telia in the uredinia broadly ellipsoid, 24–26 by 31–37 μ, rounded at both ends, somewhat constricted at septum; wall chestnut-brown, uniformly 1.5–2 μ thick, the pore of lower cell usually about half way between septum and pedicel; pedicel colorless, as long as spore, fragile, usually broken off near the spore.

The general characters of both the urediniospores and teliospores are similar to those of the two Mexican species on *Eupatorium*, *P. inanipes* and *P. espinosarum*, but not identical.

93. PUCCINIA SPEGAZZINII DeT. (on *Carduaceae*)

Mikania scandens (L.) Willd., Orotina, Dec. 30, 1915, *330*; San José, Jan. 8, 1916, *394*.

A common, short-cycle species of tropical America.

94. PUCCINIA DOLORIS Speg. (on *Carduaceae*)

Erigeron sp., San José, Jan. 10, 1916, *401*.

A short-cycle species described from Argentina, S. A., and now reported from North America for the first time.

95. PUCCINIA EXORNATA Arth. (on *Carduaceae*)

Baccharis rhexioides H.B.K., San Ramón, Jan. 13, 1916, II, III, *423*.

A long-cycle species, having all spore forms, which occurs also in Guatemala.

96. PUCCINIA OAXACANA Diet. & Holw. (on *Carduaceae*)

Conyza asperifolia (Benth.) Benth. & Hook. f. (*Baccharis hirtella* DC.), San José, Dec. 10, 1915, I, ii, III, *253*; same, Jan. 10, 1916, I, ii, III, *403*; same, Jan. 18, 1916, I, ii, III, *446*; road to Volcán de Poás, Jan. 5, 1916, II, III, *366*.

A long-cycle rust with all spore forms, occurring also in Guatemala and Mexico.

97. PUCCINIA GYMNOLOMIAE Arth. (on *Carduaceae*)

Gymnolomia microcephala Less., San José, Dec. 27, 1915, II, III, *301*.

A long-cycle species, extending northward into Mexico, but the initial stage is yet unknown.

98. PUCCINIA TITHONIAE Diet. & Holw. (on *Carduaceae*)

Tithonia rotundifolia (Mill.) Blake (*T. tagetiflora* Desf.), trail to Volcán de Poás, Jan. 5, 1916, II, III, *369*; San Ramón, Jan. 13, 1916, II, III, *425*.

A long-cycle rust of Mexico and Guatemala, whose initial stage is yet unknown.

99. PUCCINIA ABRUPTA Diet. & Holw. (on *Carduaceae*)

Viguiera silvatica Klatt, San Ramón, Jan. 13, 1916, II, *424*.

A long-cycle species, very common in Mexico, whose initial stage is unknown. It extends into Texas and into the West Indies.

100. **Puccinia proba** Jackson & Holway sp. nov. (on *Carduaceae*)

Zexmenia frutescens villosa (Polak) Blake, San José, Dec. 11, 1915, II, III, *247*; same, Jan. 3, 1916, II, III, *350*, *351*.

Zexmenia sp., Road to Fraijanes on Volcán de Poás, Jan. 6, 1916, II, III, *377*.

Pycnia epiphyllous, few, gregarious, noticeable, subepidermal, orange becoming brownish, globose or flask-shaped, 50–65 μ broad by 50–80 μ high.

Uredinia (primary) epiphyllous, crowded on slightly raised spots surrounding the pycnia, or (secondary) chiefly hypophyllous, scattered, round, small, 0.2–0.4 mm. in diameter, early naked, pulverulent, cinnamon-brown, ruptured epidermis, conspicuous; urediniospores obovoid or broadly ellipsoid, 16–19 by 20–24 μ; wall colorless or light golden-yellow, 1–1.5 μ, finely and moderately echinulate, the pores 2, equatorial.

Telia chiefly hypophyllous, scattered, round, small, 0.2–0.4 mm. in diameter, early naked, pulvinate, chocolate-brown, becoming cinereous by germination, ruptured epidermis conspicuous; teliospores ellipsoid or obovate, 16–20 by 26–34 μ, rounded above, rounded or narrowed below, not or slightly constricted at septum; wall (in resting form) chocolate-brown, 2–3 μ thick, thicker above by a broad lighter colored umbo, 3–7 μ, uniformly and finely verrucose, or (in germinating form) cinnamon- or light chestnut-brown, 1–2 μ thick, obscurely verrucose above and smooth below; pedicel colorless, once to once and a half length of spore, often deciduous.

The species is a long-cycle one without aecia, and is well marked and especially characteristic in having teliospores that are dark and thick walled in some sori and light and thinner walled in others, the former being in resting condition and the latter germinating like a leptoform.

101. **Puccinia absicca** Jackson & Holway sp. nov. (on *Carduaceae*)

Zexmenia frutescens villosa (Polak) Blake, San José, Dec. 10, 1915, O, III, *239*.

Pycnia epiphyllous, few, gregarious, yellowish or light orange, conspicuous, subepidermal, globoid, 30–50 μ broad.

Telia epiphyllous, numerous in crowded, orbicular groups surrounding the pycnia, or in elongated groups on the veins, roundish, 0.5–0.8 mm. across, somewhat tardily naked, pulverulent, chestnut-brown, surrounding epidermis conspicuous; teliospores ellipsoid, 20–24 by 28–34 μ, rounded at both ends, not or slightly constricted at the septum; wall cinnamon- to chestnut-brown, 2–2.5 μ thick, thicker above, 5–7 μ, moderately verrucose-rugose, often

slightly striate, the pore of lower cell near the pedicel; pedicel short, fragile, colorless.

This appears to be the correlated short-cycle form for *Puccinia proba* Jacks. & Holw. Its spore structures are morphologically nearly or quite identical with those of that species.

102. PUCCINIA OYEDAEAE Mayor (on *Carduaceae*)

Oyedaea acuminata (Benth.) Benth. & Hook. f., Tres Rios near San José, Dec. 20, 1915, O, I, II, III, *274*; San José, Jan. 3, 1916, O, I, II, *356*.

The species was founded on a telial collection from Colombia, S. A., the host being an undetermined species of *Oyedaea*. It was classed as one of the Leptopuccinias. Prof. Holway's collections, the first for North America, supply all the other stages, which may be characterized as follows.

Pycnia epiphyllous, in small groups, chocolate-brown, conspicuous, subepidermal, globoid, 112–128 μ in diameter.

Aecia epiphyllous, associated with the pycnia in groups 0.3–2 mm. across, cupulate; peridium white, erose; peridial cells linear oblong, 5–7 by 26–35 μ, abutted, the walls 1.5–2 μ thick; aeciospores broadly ellipsoid, 23–26 by 26–32 μ; wall yellowish, 3 μ thick, thickening up to 4–7 μ at apex, closely tuberculate-verrucose.

Uredinia hypophyllous, scattered, round, 0.1–0.4 mm. across, early naked, pulverulent, dark cinnamon-brown, ruptured epidermis inconspicuous; urediniospores globoid or broadly ellipsoid, 23–27 by 26–32 μ; wall dark cinnamon-brown, thick, 2.5–3 μ, closely echinulate, the pores 6–10, scattered.

Excellent drawings of the long and narrow teliospores are given by Mayor (Mem. Soc. Neuch. Sci. Nat. 5: 535. 1913). These are strongly thickened at the apex, and of a decided brown color, becoming nearly or quite colorless below.

103. PUCCINIA CALEAE Arth. (on *Carduaceae*)

Calea urticifolia (Mill.) DC., San José, Dec. 10, 1915, ii, III, *243*; same, Jan. 3, 1916, III, *349*; same, O, I, II, *357*; Heredia, Dec. 17, 1915, II, III, *265*; Orotina, Dec. 31, 1915, II, III, *339*.

A long-cycle rust, occurring also in Guatemala and Mexico.

104. PUCCINIA FEROX Diet. & Holw. (on *Carduaceae*)

Verbesina myriocephala Sch. Bip., San Ramón, Jan. 13, 1916, III, *418*.

A short-cycle rust, heretofore only known from Mexico.

105. PUCCINIA TAGETICOLA Diet. & Holw. (on *Carduaceae*)

Tagetes filifolia Lag., San José, Dec. 10, 1915, III, *242*.
Tagetes microglossa Benth., San José, Dec. 10, 1915, II, *241*.

A long-cycle rust, found in Mexico, the West Indies, and in South America, the initial stage being still unknown.

106. PUCCINIA ABSINTHII DC. (on *Carduaceae*)

Artemisia vulgaris L., in a garden near San José, Dec. 28, 1915, II, *308*.

A long-cycle rust, having pycnia, uredinia and telia, very common and widely distributed. It has not before been reported on this host from North America.

107. PUCCINIA COGNATA Syd. (on *Carduaceae*)

Verbesina turbacensis H.B.K., San Ramón, Jan. 13, 1916, II, *422*.

As only uredinia are present, the reference to this species is somewhat uncertain, especially as the host has not before been recorded for it.

108. ENDOPHYLLUM CIRCUMSCRIPTUM (Schw.) W. & O. (on *Vitaceae*)

Cissus sicyoides L.

A short-cycle species, very common in tropical America on various species of *Cissus*. It was collected at San José, on *C. sicyoides*, in 1911, by A. Tonduz, and a specimen communicated by N. Patouillard.

FORM-SPECIES BELONGING TO AECIDIACEAE

109. **Aecidium albicans** Arthur & Holway, sp. nov. (on *Euphorbiaceae*)

Phyllanthus acuminatus Vahl, San José, Dec. 26, 1915, *294*; Orotina, Dec. 30, 1915, *327* (type).

Pycnia hypophyllous, few, associated with small groups of aecia, subepidermal, ovoid, 24–48 μ broad by 48–67 μ high.

Aecia hypophyllous, rarely in small groups associated with pycnia, usually scattered by ones and twos without pycnia, short-cylindric, 0.1 mm. or less across, 0.1–0.3 mm. high; peridium white, the margin recurved, erose; peridial cells rhombic, 12–13 by 16–19 μ, abutted, the walls evenly 1.5–3 μ thick, the outer one smooth, the inner one very finely verrucose; aeciospores angularly globoid or ellipsoid, 13–16 by 16–19 μ; wall colorless, 1–1.5 μ thick, finely and closely verrucose.

Five species of *Aecidium* have previously been described on *Phyllanthus,* from all of which the present collection apparently differs in having the aecia conspicuously scattered. Microscopic comparison has been made with *A. detritum* P. Henn. from Uruguay, and *A. favaceum* Arth. from Porto Rico, both of which have much larger spores. The descriptions of *A. Phyllanthi* P. Henn. from New Guinea, *A. phyllanthinum* Syd. from Assam, and *A. luzoniense* P. Henn. from the Luzon, appears to be distinctive, and unlike any of the American forms.

110. AECIDIUM TUBULOSUM Pat. & Gaill. (on *Solanaceae*)

Solanum torvum Sw., Orotina, Dec. 31, 1915, *341.*

A common aecial rust of the tropics on *Solanum torvum* and closely related hosts, which according to the observations of Whetzel and Olive in Porto Rico doubtless is one stage of the grass rust, *Puccinia substriata.*

111. **Aecidium tenerius** Arthur & Holway sp. nov. (on *Solanaceae*)

Acnistus arborescens Schlecht., San José, Jan. 3, 1916, *362.*

Aecia hypophyllous, scattered or loosely grouped, round, 0.3–0.8 mm. across; peridium inconspicuous, usually hidden by the persistent epidermis, or evanescent; peridial cells long and narrow in side view, often becoming curved, 5–9 by 29–48 μ, the outer and inner walls quite thin, the inner very finely and inconspicuously verrucose; aeciospores globoid or ellipsoid, 19–23 by 24–32 μ; wall colorless, 2–2.5 μ thick, frequently slightly thicker both above and below, inconspicuously verrucose, appearing smooth when wet.

The delicate peridium gives a very different appearance to this

rust than is presented by the aecia of *Puccinia Acnisti* Arth., found on the same host about in the same region. The habit also differs from *A. solanitum* Speg., which appears like a systemic form.

112. AECIDIUM ABSCEDENS Arth. (on *Rubiaceae*)

Randia aculeata L., San José, Dec. 15, 1915, *258*.

This apparently heteroecious species has heretofore only been known from Porto Rico (Mycol. 7: 315. 1915).

113. **Aecidium ampliatum** Jackson & Holway sp. nov. (on *Carduaceae*)

Eupatorium sp., El Alto near Cartago, Jan. 16, 1916, *434*.

Pycnia epiphyllous, gregarious, conspicuous, yellowish becoming orange, subepidermal, globoid or flask-shaped, 80–100 μ broad; ostiolar filaments short.

Aecia hypophyllous, crowded on yellowish spots 2–8 mm. across, opposite the pycnia, cupulate; peridium strongly recurved, lacerate; peridial cells rhomboidal, 21–23 by 42–45 μ, considerably overlapping, the outer wall 2.5–3 μ thick, smooth, the inner wall 3.5–4.5 μ thick, prominently rugose-verrucose; aeciospores globoid or broadly ellipsoid, 23–27 by 27–30 μ; wall colorless, thin, 1 μ, very finely and closely verrucose.

It can not be predicted whether this form is the aecium of an autoecious or heteroecious species.

114. **Uredo Arundinellae** Arthur & Holway sp. nov. (on *Poaceae*)

Arundinella Deppeana Nees, San Ramón, Jan. 14, 1916, *431*.

Uredinia hypophyllous, scattered, oval or oblong, minute, 0.1–0.3 mm. long, early naked, pulverulent, cinnamon-brown, ruptured epidermis evident; urediniospores broadly ellipsoid, globoid or obovoid, 26–29 by 27–37 μ; wall cinnamon-brown, thin, 1–1.5 μ, moderately echinulate, the pores usually 3, sometimes 2 or 4, equatorial.

Morphologically the species is similar to *P. Arundinariae*, but the urediniospores are somewhat larger, and with a much thinner wall. The pores are also more variable in number. As the hosts are only distantly related it is quite certain that the two rusts are only superficially associated.

115. **Uredo americana** (Mass.) comb. nov. (on *Orchidaceae*)

Cattleya Dowiana Bat.

This rust occurred on plants brought to the Kew conservatories from Costa Rica. The record was made in the Kew Bulletin for 1906, page 40, where it says that "only a small patch of rust was present on one leaf when the plant was received from Costa Rica, but this has continued to increase in size, and the falling spores have also inoculated other leaves." Upon application to the Kew Herbarium, a generous portion of the specimen preserved there was sent me on Oct. 11, 1915. The specimen bears the date "1899." I was unable, however, to find any rust upon the part submitted.

The writer has already recorded (Science **40**:935. 1914) his belief that the assignment of this and similar Orchidaceous rusts to the genus *Hemileia* is not well founded. The opinion is shared with other uredinologists (Sydow, Monog. Ured. **3**:221. 1914) that the description of teliospores made by Massee applies rather to over-mature urediniospores. The distinctive characters of the genus *Hemileia* of agglutinated pedicels and one-sided, dorsiventral urediniospores, the ventral side being smooth, are lacking among these orchid rusts. Moreover, it is difficult to believe that families of hosts so widely separated as the monocotyledonous Orchidaceae and the dicotyledonous Rubiaceae would bear closely related species of rusts of a restricted generic form. For these reasons this rust, which has heretofore been called *Hemileia americana* Mass. (Gard. Chron. III. **38**:153. 1905) is transferred to the genus *Uredo*.

There are reasons for believing that Orchidaceous rusts of this character are to be associated with certain rusts of the Polypodiaceae, represented by *Uredo superficialis* (Speg.) DeT., and *U. Gymnogrammes* P. Henn. They have the same peculiar formation of uredinia, the sori being tufted hyphae protruding through the stomata, and are likely to divulge the same general characteristics of the teliospore. Teliospores of the fern rusts have been found which are of the general *Puccinia*-form. Massee's view that the teliospores of the orchid rusts are of the *Uromyces*-form can safely be ignored. If these characters can be fully

established by further collections and study, the two groups of rusts should be given independent generic rank.

116. UREDO MACULANS Pat. & Gaill. (on *Amaranthaceae*)

Achyranthes sp., Alajuela, Jan. 7, 1916, *382*.

This is the first record of the species for North America. It has recently been collected in Panama, however, on *A. Williamsii* Standley, March 6, 1913, by E. Bethel. The species was originally described from Venezuela (Bull. Soc. Myc. Fr. 4:98. 1888), and is also known from Ecuador.

117. UREDO HAMELIAE Arth. (on *Rubiaceae*)

Hamelia erecta Jacq., San José, Jan. 8, 1916, *390*.

Heretofore the species has only been known from two collections from Porto Rico (Mycol. 8:23. 1916; and 9:95. 1917).

118. **Uredo suspecta** Jackson & Holway sp. nov. (on *Carduaceae*)

Eupatorium daleoides (DC.) Hemsl. (?), Cartago, Jan. 20, 1916, *448*.

Uredinia hypophyllous, few, gregarious or scattered, dark cinnamon-brown, ruptured epidermis conspicuous; urediniospores ellipsoid or obovoid, 26–29 by 30–35 μ; wall dark cinnamon-brown, 2–2.5 μ thick, echinulate, the pores 2, equatorial.

This uredinial form doubtless belongs to some species of *Puccinia*. It is much like *P. Clinopodii*, but has much larger spores with thicker walls. No telia on a smooth-leaved *Eupatorium* similar to the host in hand, which could belong with such a form, have yet been seen.

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HOST INDEX

PURDUE UNIVERSITY,
LAFAYETTE, INDIANA.

CONIDIAL FORMATION IN SPHAERONEMA FIMBRIATUM[1]

S. G. LEHMAN[2]

(WITH PLATE 7, CONTAINING 19 FIGURES)

During the past two years, a study has been made of the morphology and development of *Sphaeronema fimbriatum* (Ellis & Hark.) Sacc., a fungus causing a black-rot disease of the sweet potato (*Ipomoea batatas*). This organism is known to give rise to propagative bodies of several types, one of which is designated as hyaline conidia, another as olive conidia. The accounts by previous investigators are not entirely concordant, and certain of them appear to inadequately describe and interpret the formation of these structures. The purpose of this paper is, therefore, to set forth in detail the manner of formation of these two types of conidia and to compare these structures with the so-called endoconidia of *Thielavia basicola* Zopf.

While it is entirely beyond the scope of this article to review the literature on endoconidial formation in fungi, a proper understanding of the present problem necessitates a summary of the most important investigations on *Sphaeronema* and *Thielavia*. According to the account of Halsted and Fairchild (1), who first made a detailed study of *Sphaeronema fimbriatum*, the protoplast of the conidiophore which produces hyaline conidia ruptures or absorbs the apical wall of the conidiophore. A septum is then formed below the mouth of the conidiophore, thus cutting off the end of the protoplast to form a conidium. This conidium is pushed beyond the mouth of the conidiophore by growth of

[1] This paper is taken from a thesis presented to the North Carolina State College of Agriculture and Engineering in partial fulfilment of the requirements for the degree of Master of Arts.

[2] The writer is greatly indebted to Dr. F. A. Wolf for many helpful suggestions during the progress of the work and for aid in preparing the manuscript.

the protoplast behind it, and a number of other conidia are formed successively in the same manner. The mode of formation of the olive conidia differs from that of the hyaline conidia only in that they are not produced so rapidly, and in such other respects as are made necessary by differences in size and shape of the conidia.

Taubenhaus (2), in his studies of sweet potato black rots, states that spore formation in *Sphaeronema fimbriatum* resembles that in *Thielavia* in that "the spores are borne within the sheath of a terminal cell, and these are pushed out from within."

Concerning the manner of spore formation in *Thielavia basicola*, Zopf (3) states that the conidia of *Thielavia basicola* are formed in acropetal succession on short, several-celled conidiophores. The wall of each conidium becomes differentiated into two lamellae, the inner of which becomes the lateral wall of the conidium and the outer, the sheath out of which the conidia pass successively.

Gilbert (5) differing from Zopf's view, applies the term "endoconidia" to the spores of *Thielavia basicola* which "originate within the terminal cell and are not formed by its direct septation."

Brierley's (4) conclusions from a study of conidial formation in *Thielavia basicola* are at variance with both of these accounts. He affirms that the conidia are not formed endosporously within an endoconidial cell, but are acrogenously abjointed from the conidiophore. The first conidium is then liberated by a tangential splitting of its walls, which thus become differentiated into an outer closed sheath and an internal spore membrane. This outer sheath then ruptures, freeing the first conidium. Conidia subsequently produced are formed in the rear of the first in a manner in all respects like that of the first. Brierley further states that the process of conidial formation as he has described it for *Thielavia*, is probably that of all other "endoconidia" in fungi.

Methods

In order to facilitate the observations recorded in this study, *Sphaeronema fimbriatum* was grown upon various substrata.

For part of the work, the fungus was grown on both cooked and uncooked sweet potato tissue for periods varying from thirty-six hours to six days. Material was then fixed in weak chromo-acetic solution (Schaffner's formula), dehydrated, imbedded in paraffin, sectioned 3 to 5 μ thick and stained either with Flemming's triple stain or Haidenhain's iron-alum haematoxylon. Mycelial mats grown on sterilized cornmeal as a substratum were likewise fixed, sectioned, and stained. For the study of living specimens, material grown on a substratum of 10 gr. wheat flour and 40 c.c. of water was especially favorable because of the unusually large size of the conidiophores. Very good differentiation was obtained when living conidiophores were stained for a few minutes in a one per cent. solution of safranin in fifty per cent. alcohol. Many observations were also made on living unstained material. The course of development of the two types of sporophores was followed by observations on the fungus cultured in Van Tieghem cells.

THE CONIDIOPHORE

Short spore-bearing branches, termed by Halsted and Fairchild (1) the primary sporophores, arise in great numbers from both aerial and subsurface hyphae. These primary sporophores are produced singly or in clusters of as many as six. When formed in clusters, the younger sporophore arises in order from a basal cell of the next older (Fig. 2). These structures are typically somewhat fusiform and usually consist of a basal portion of one to four short, more or less barrel-shaped cells with a long, tapering terminal cell which gives rise to the hyaline conidia. The primary sporophores vary in length, for the most part, from 70 to 100 μ and measure 4.5 to 6.5 μ at the thickest place. The terminal cell of the primary sporophore is herein designated the conidiophore. The conidiophore commonly has a length equal to or greater than one half the total length of the primary sporophore and the tip is usually narrower by 1 to 1.5 μ than the bulbous basal portion.

CONIDIAL FORMATION

At the initiation of the formation of the hyaline conidia, the distal end of the conidiophore is filled with protoplasm of a high refractive index, and contains a number of oil globules (Fig. 11) and sometimes small vacuoles. The basal portion may be occupied by a large vacuole surrounded by a thin layer of cytoplasm (Fig. 11). Shortly after a conidiophore has reached mature size, examination with great magnification ($\times$ 2270) shows that its apical portion contains a fully formed conidium which has a distinct wall. This conidium is separated from the protoplast and wall of the conidiophore by a distinct line in such a manner that the wall of the conidiophore appears as a closed sheath about the conidium (Figs. 8, 9). This line of separation is visible when living specimens have been stained with safranin and the protoplast has been slightly plasmolyzed. When preparations are made in this manner, the protoplast takes the stain and the wall of the conidium and of the conidiophore remains clear. When the protoplast has not been plasmolyzed, however, the lateral conidial wall is pressed so closely against its sheath as to make the line of separation entirely invisible (Fig. 10). However, the line delimiting the basal wall of the conidium from the wall clothing the end of the protoplast of the conidiophore can at this time be discerned plainly. At each end of this line, a wedge-shaped opening caused by the convexity of the end of the protoplast and of the opposed newly formed conidium, is clearly seen. The size of this space depends upon the pressure exerted by the growing protoplast against the conidium above. When the pressure is great, the end of the protoplast is flattened against that of the conidium and the wedge-shaped space reduced (Fig. 8–10). In case the line separating the conidium from its sheath was visible, it is represented by a solid line (Figs. 8–10), otherwise, by a broken line. Other conidiophores are not uncommonly found whose distal ends contain a second fully formed conidium just below the first (Fig. 8). No more than two conidia within the sheath, however, have been observed. Careful examination of the free end of the sheath containing these conidia (Figs. 8, 9) shows that it is still intact and that the two conidia

have been formed acrogenously within the closed cell. The wall of the conidium is nearly, if not fully, as thick as that of the sheath surrounding it. This sheath does not appear thinner than the wall of the apical portion of the conidiophore before conidia had formed within it, nor yet less thick than the wall of the basal portion of the conidiophore.

After the formation of the second conidium within the conidiophore, or sometimes after the formation of the first, the apex of the sheath is dissolved and the conidia within are pushed out by growth of the protoplast behind them (Figs. 3, 5, 10). The fact that the opening at the end of the sheath is always bounded by a smooth line indicates that the tip has been dissolved; for if it were forcibly ruptured, the end should appear torn and broken. As soon as the protoplast has sufficiently elongated (Fig. 4), the next conidium is delimited and pushed out by continued growth of the protoplast. This process is repeated a great many times in succession, so that the acrogenously formed conidia appear in long chains (Fig. 1). Chains of as many as fifty-nine conidia have been observed. These conidia are hyaline, elongated, and have rounded, or often very angular ends (Figs. 1, 3 and 5). They may have a uniformly hyaline content with a single vacuole at each end, or the ends may be filled with granular protoplasm, leaving a clear zone at the middle. When the protoplasm at the ends is granular, numerous oil droplets can be seen within it. These conidia sometimes burst upon being put into water, whereupon the granules exhibit a Brownian movement. This has often been noted within unbroken conidia. The diameter of conidia produced by the same conidiophore is very uniform, but considerable variation in length obtains. The first conidia produced are longest, the last are shortest and the intermediate ones intergrade between the two extremes.

The method of spore formation by which the olive conidia arise, differs in certain particulars from that of the hyaline conidia. The conidiophore is typically short and unicellular as shown in Figs. 13, 14, and 16. There are those, however, whose length is equal to that of the primary sporophores (Fig. 17) and they may resemble these in shape. When the conidiophore

is fully developed, the first evidence of conidial formation consists in the dissolution of its apical wall. This is followed by the protrusion of the protoplast (Fig. 14) which is surrounded by a thin membrane. The protoplast enlarges greatly and becomes more or less pyriform with the narrow portion fitting as a plug into the mouth of the conidiophore (Fig. 15–17). Meanwhile, a septum delimiting the first pear-shaped conidium is being formed a short distance back of the mouth. The continued growth of the protoplast behind this conidium forces it beyond the mouth of the conidiophore. The apical portion of the enlarging protoplast then becomes delimited, forming the second conidium in a manner entirely similar to the first.

Olive conidia vary greatly in size and shape (Figs. 13, 15–17). In case formation progresses rapidly so that each conidium is pushed beyond the mouth of the conidiophore before its wall thickens, pressure within the conidium causes it to assume an elliptical shape. On the contrary, when conidial formation is less rapid, and the wall of a conidium becomes rigid before it is entirely without the conidiophore, its original pyriform shape is retained.

When first formed, these conidia are hyaline, but within 48 hours become olive-brown. They have a granular protoplasm having a varying number of oil droplets, the reserve food (Figs. 15, 17). As the conidia become older, the brown wall becomes thick and resistant (Figs. 18, 19). When these are placed in 50 per cent. sulphuric acid solution, the outer heavy wall bursts and a very thin, hyaline-walled vesicle slips out. Within a few moments this ruptures, liberating the protoplasmic contents. Most olive conidia range in size from 12 to 16 by 8 to 12 μ, a few being larger or smaller. In old cultures the smaller conidia predominate.

Discussion

Upon comparing the account of conidial formation given above with that for *Thielavia basicola* by Brierley (4), certain essential points of difference can be noted:

1. If the first conidium of *Sphaeronema fimbriatum* were produced, as in *Thielavia*, by direct septation of the conidiophore and

subsequently liberated by a tangential splitting of its walls to form an outer sheath, the thickness of the sheath, as well as of the wall of the conidium, should be half that of the wall of the conidiophore before conidial formation. Instead of this, one finds that the wall of the conidium is nearly, if not quite, as thick as that of the sheath surrounding it. The sheath does not appear thinner than the apical wall of the conidiophore before conidia formed within it, nor less thick than that of the basal portion of this cell (Figs. 8–11).

2. It is clearly seen from Figs. 8–11 that the end of the protoplast of the conidiophore is not naked but protected by a wall fully as thick as that about the conidium above it. It is believed that this wall extends for some distance back from the tip. In Fig. 6, at (*b*), the wall of the protoplast is clearly separated from the sheath. At (*c*) the wall presses so closely to the sheath that the line of separation cannot be distinguished although they appear separate again at (*a*) for a short distance. In Fig. 7, the protoplast is seen to have grown beyond the sheath for a considerable distance without having formed conidia. It is invested with a delicate wall which is separated from the sheath for almost one-half the length of the conidiophore. The fact that this protoplast clothes itself with a wall for a distance from its tip greater than the length of a conidium indicates that the conidia are not formed by direct septation of the conidiophore and that the sheath takes no part in the formation of the conidial wall. The septum cutting off each conidium must arise from the new wall with which the protoplast invests itself and not directly from the wall of the conidiophore.

3. In several instances conidia, as illustrated in Fig. 12, have been observed which had germinated prior to escape from the conidiophore. This indicates that conidia mature while still wholly within the sheath.

On the basis of the evidence presented and discussed above, in which conidial formation for *Sphaeronema* seems to differ from *Thielavia*, the first and often the second, hyaline conidium in a series can properly be regarded as an endoconidium. It is clearly delimited within a closed cell whose wall remains intact

until the conidium has reached maturity. However, conidia produced subsequently to the second, cannot be regarded as endoconidia, for while they are formed within a sheath, this sheath is open at the tip. In true endospore formation, the spores are delimited within a closed cell, although the spore walls may not develop until after escape of the spore masses.

It is apparent that the olive conidia are not endospores. They are formed by the swelling of the protoplast beyond the opening at the tip of the conidiophore and are not separated from the protoplast until the conidium has reached mature size.

SUMMARY

1. A study has been made of the formation of the hyaline and the olive-brown conidia of *Sphaeronema fimbriatum*.

2. Contrary to Brierley's anticipations, the process of conidial formation in *Sphaeronema* differs in certain particulars from that in *Thielavia*.

3. In the formation of the first conidium, the distal end of the protoplast of the conidiophore invests itself with a new wall and separates as a conidium.

4. This conidium is liberated by dissolution of the tip of the conidiophore.

5. Often a second conidium is formed in the same manner as the first and before dissolution of the tip of the conidiophore.

6. The first two conidia should be regarded as endoconidia.

7. Conidia produced subsequently to the second are not endoconidia.

8. Olive-brown conidia are not produced endosporously.

STATE COLLEGE,
WEST RALEIGH, N. C.

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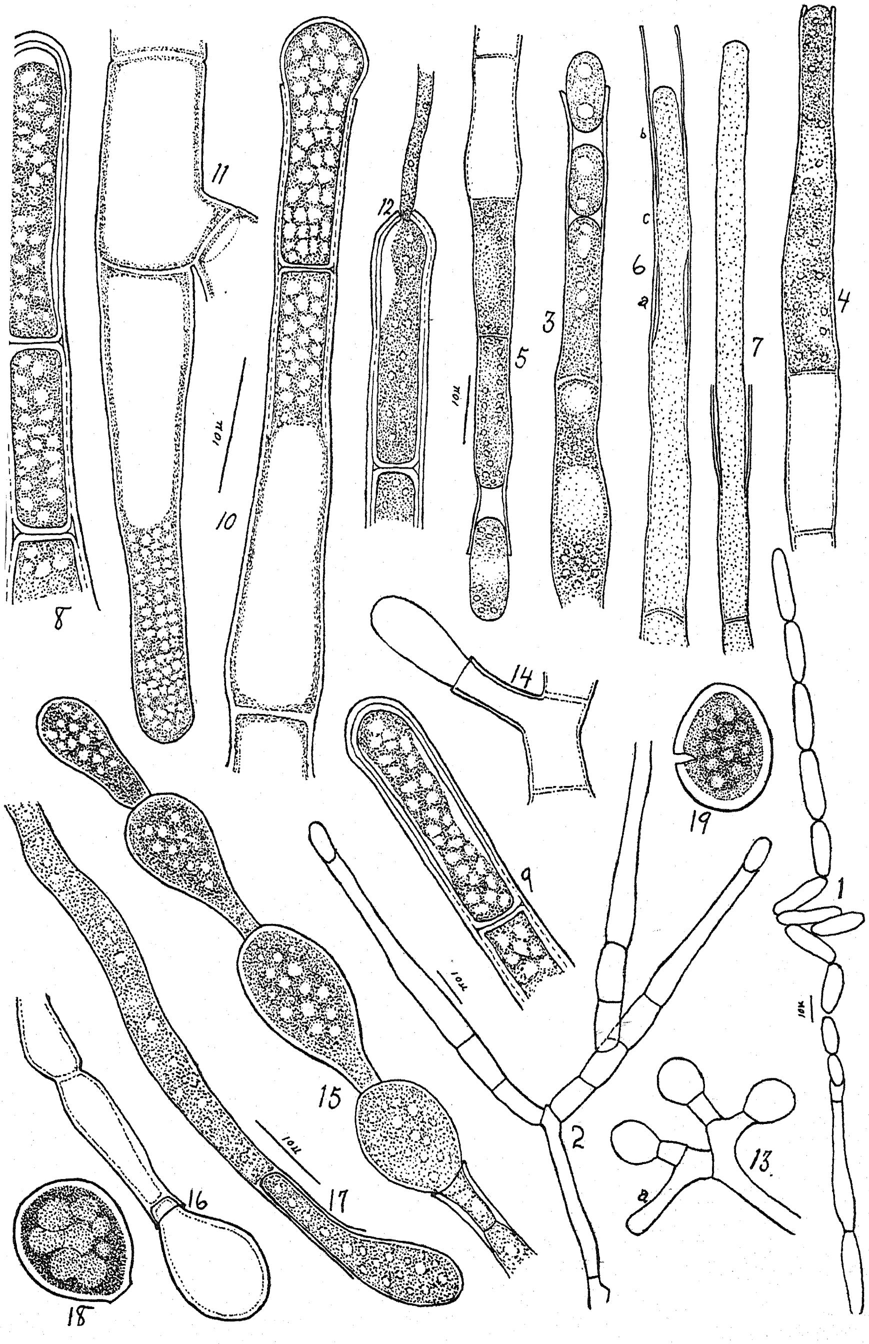
EXPLANATION OF PLATE 7

All the drawings were outlined and as many as possible of the details put in with the aid of a camera lucida. A different magnification was used for each of the following groups of figures: 1; 2, 13; 3–7, 14–17; 8–12. The reduced magnification can easily be calculated from the scale given with each group.



SPHAERONEMA FIMBRIATUM

Fig. 1. Conidiophore producing hyaline conidia.

Fig. 2. Cluster of three conidiophores producing hyaline conidia.

Figs. 3 and 5. Conidiophores with hyaline conidia escaping.

Fig. 4. Conidiophore out of which all conidia have been forced by growth of the protoplast behind them preparatory to formation of other conidia.

Figs. 6 and 7. Conidiophores. See text for explanation.

Fig. 8. Distal end of a conidiophore showing two fully formed conidia within the unbroken sheath.

Fig. 9. Similar to Fig. 8, but showing only one conidium within the sheath.

Fig. 10. The tip of the conidiophore has been dissolved and the first-formed conidium is being slowly shoved out by growth of the protoplast behind it.

Fig. 11. Conidiophore shortly before formation of the first conidium.

Fig. 12. Conidium germinating while still within its sheath.

Fig. 13. Group of conidiophores producing olive conidia.

Fig. 14. Higher magnification of Fig. 13 (*a*) showing how the protoplast grows out to form the first olive conidium.

Fig. 15. Chain of olive conidia showing variation in shape and size and how each conidium is delimited by a wall below the mouth of the conidiophore.

Fig. 16. Conidiophore with an olive conidium plugging its mouth.

Fig. 17. An unusually long conidiophore of this type. The conidium is completely delimited but has not assumed its final shape.

Figs. 18, 19. Olive conidia with thick walls characteristic of mature spores.

NOTES ON NEW SPECIES OF FUNGI FROM VARIOUS LOCALITIES—II

Charles E. Fairman

1. **Phoma verbascicarpa** sp. nov.

Pycnidia scattered or gregarious, erumpent, superficial, globose or oblong, centrally ostiolate by a minute pore, black, small, about 75 μ in diameter, filled with minute continuous, rounded or ellipsoid sporules; spores hyaline, $3–4 \times 2–3\,\mu$; basidia not seen.

On fruit capsules of *Verbascum Blattaria* L., Orient, N. Y., March, 1915, *Roy Latham.*

2. **Phomopsis ericaceana** sp. nov.

Pycnidia immersed then erumpent, black, minute; spores simple, oblong-fusoid, with one minute oil drop in each end, hyaline, $7–10 \times 2\,\mu$; basidia slender, curved or straight, hyaline, $12–14 \times 2\,\mu$.

On dead branches of cultivated *Azalea mollis,* Lyndonville, N. Y., May, 1916, *Charles E. Fairman.*

3. **Sphaeropsis wistariana** sp. nov.

Pycnidia immersed in the inner bark in clusters of 1–3, then erumpent, numerous, minute, black; spores arising from hyaline basidia, oblong-ellipsoid, continuous, brown, $15–22 \times 6\,\mu$.

On dead branches of cultivated *Wistaria,* Lyndonville, N. Y., June, 1915, *Charles E. Fairman.*

4. **Sphaeropsis Diervillae** sp. nov.

Pycnidia single or in groups of 2 or 3, immersed in the inner bark, then erumpent, elevating the bark in pustules and becoming exposed, ostiolate, black, 150–300 μ in diameter; spores oblong-ellipsoid, rounded at the ends, nucleolate, brown, $15–20 \times 10\,\mu$, on stout, short sporophores.

On dead branches of *Diervilla Diervilla* (L.) MacM., Lyndonville, N. Y., *Charles E. Fairman.*

5. **Camarosporium wistarianum** sp. nov.

Pycnidia immersed then erumpent through longitudinal rifts in the elevated bark, scattered or gregarious, globose, ostiolate, black, 130–175 μ in diameter; spores numerous, ellipsoid or fusoid-oblong, rounded at the ends, not usually constricted but occasionally deeply constricted at the middle, and then separable, 3–5 septate, one or more of the cells with a longitudinal septum, hyaline, then brown, $17–25 \times 6–9\ \mu$.

On dead branches of cultivated *Wistaria*, Lyndonville, N. Y., June, 1915, *Charles E. Fairman*.

6. **Rhabdospora translucens** sp. nov.

Pycnidia immersed then erumpent, soft, membranaceous, under the microscope translucent, black, 150–300 μ in diameter, filled with numerous spores which are simple, curved, crescentic or fusoid, always narrowed toward the ends, sessile or with indistinct basidia, hyaline, $23–33 \times 2–3\ \mu$.

On dead branches of *Tecoma radicans* (L.) DC., Lyndonville, N. Y., May, 1916, *Charles E. Fairman*.

7. **Microdiplodia Diervillae** sp. nov.

Pycnidia associated with, and resembling in every way those of *Sphaeropsis Diervillae;* spores oblong-ellipsoid, rounded at the ends, straight or curved, not constricted, hyaline at first, then becoming olivaceous, or very light brown, $7–10 \times 3–4.5\ \mu$.

On dead branches of *Diervilla Diervilla* (L.) MacM., Lyndonville, N. Y., *Charles E. Fairman*.

The color of the spores resembles *Diplodia hyalospora* C. & E.

8. **Hendersonia hortilecta** sp. nov.

Pycnidia numerous, depressed-globose, centrally ostiolate, black, 175–200 μ in diameter; spores oblong-fusoid, 3–6-septate, the middle cells largest, more or less constricted at the septa, and when deeply constricted at the septa appearing subtorulose, hyaline then brown, $17–27 \times 5–7\ \mu$.

On dead branches of *Clematis paniculata* in a garden, Lyndonville, N. Y., May, 1915, *Charles E. Fairman*.

Obs. The spores vary considerably from slightly constricted to torulose, and 3–5-septate. Usually they are 3-septate and not constricted.

Differs from described species on *Clematis,* as follows: *Hendersonia Rubi* (West.) Sacc. var. *Clematidis* Strasser on *Clematis vitalba* has spores 34 × 5–7 μ. *Hendersonia calycina* Brun. on *Clematis calycina* has spores 18 × 6 μ, and *H. sarmentorum* West. var. *Clematidis* Trav. on *Clematis vitalba* is said to have spores 13–15 × 5–7 μ. *H. Clematidis* Hollos is said to occur on *Clematis integrifolia* and to afford spores 24–26 × 2–2.5 μ. From all these the form on *Clematis paniculata* differs in size and subtorulose form of the spores, and probably from the fact that the branches invaded by the fungus assume a reddish to faint copper-colored tint.

9. **Dictyochora Gambellii** sp. nov.

Stroma at first subepidermal, becoming erumpent and splitting the epidemis in an hysteriiform manner, running longitudinally along the stem; loculi in groups of 2–9, rounded or by compression angular, black, 150–470 μ in diameter; asci clavate-cylindric, short-stipitate, 100 × 10–12 μ; paraphyses absent; sporidia obliquely uniseriate, or subbiseriate above, 5–7-septate, slightly constricted at the septa, the end cells usually simple, intermediate cells muriform, fusoid-oblong, yellowish-brown, becoming opaque, 20–27 × 7–10 μ.

On dead stems of *Zea Mays* L., north farm of old Gambell farms, Yates, N. Y., May, 1916, *Charles E. Fairman.*

10. **Platystomum phyllogenum** sp. nov.

Perithecia immersed then erumpent vertically, or at times laterally inclined, single or in groups of 2 to 3, with a more or less broad and compressed ostiolum, small, black; asci cylindric, short-stipitate, rounded at the apex, straight or curved, 8-spored, 100–112 × 12 μ, surrounded by numerous filiform paraphyses; spores obliquely uniseriate, ellipsoid, rounded at the ends, 3-septate, not constricted, one or more cells muriform, hyaline at first, becoming smoky, olivaceous or pale-brown, 12–18 × 9–10 μ.

On leaves (mostly on the midrib or veinlets) of *Anastraphia Northrupiana* on rocks, Province of Pinar del Rio, Bay of Mariel, Cuba, *N. L. Britton* and *C. S. Gager,* Herb. N. Y. Bot. Garden, *7678, 7678a,* and Mycotheca Fairmani *3535.*

No spots are formed on the leaves by the growth of the fungus,

and the perithecia are hypophyllous. Species of Lophiostomataceae rarely occur on leaves. It may be that the tissues of leaves are not thick enough for the proper development of the perithecia. The thick leaves of *Anastraphia* seem specially adapted to the growth of our species. I have found a record of the following species of the Lophiostomataceae on leaves, viz.:

Lophiosphaera perpusilla Sacc. on leaves of *Carex;*
Lophiotrema stenogramma (Dur. et Mont.) Sacc. on leaves of *Quercus;*
Lophiotrema pusillum Fuckel. on leaves of *Calamagrostis;*
Lophiostoma collinum Speg. on leaves of *Carex;*
Lophiotrema Mollerianum (Wint.) Berl. & Vogl. on leaves of *Quercus.*

LYNDONVILLE, N. Y.

STUDIES IN NORTH AMERICAN PERONOSPORALES—VII. NEW AND NOTEWORTHY SPECIES

Guy West Wilson

Peronospora grisea Unger

This is one of the rarer members of the genus, at least in America. It is confined to various species of *Veronica* in the northern portion of the United States and Canada, as well as in Europe. It was with considerable interest that this species was found in the field last spring near Carmel, Indiana, where in April it was very abundant on the young plants of *V. arvensis* L., causing a pronounced and conspicuous yellowing of the infected leaves. It persisted through May, and during the latter month it was found sparingly in the same locality on *V. peregrina* L. On this host, the surface discoloration was red, very similar to that caused by the work of aphids. In this connection it might be of interest to note that in the case of other species of *Peronospora* which normally cause a yellowish discoloration of the host, especially *P. Polygoni* Thüm., this was of a decided reddish cast during the cold, wet weeks of spring. In early June, the normal color was the prevalent one.

Peronospora Seymourii Burrill

This species was abundant on *Houstonia minor* (Michx.) Britton at Iowa City, Iowa, in April, 1915. So far as the writer knows, but two previous collections have been recorded. The type was collected in Union county, Illinois, by Prof. Seymour, the other collection being made in Alabama by Dr. Underwood.[1] In the Iowa material, the oöspores are produced abundantly in the fruits of the host, causing a slight hypertrophy and a decided purplish color.

[1] Underwood, Bull. Torrey Club 24: 83. 1897.

Rhysotheca Acalyphae sp. nov.

Hypophyllous, forming a dense or very sparse, whitish growth on the host, epiphyllous discoloration prominent, yellowish to dark-brown, appearing to cause dead spots on the leaves, often accompanied by a pronounced tinge of red on the under side of the leaf; conidiophores solitary or only 2 or 3 from a stoma, 300–500 $\times$ 5–7 μ, 4–5 times branched, forming a loose, open head of about ½ to ⅓ the total height, branches elongate, straightish, branchlets sometimes at a very small angle, ultimate branchlets straight, slightly flexed, short, 4–10 μ long, more or less conic and broadly truncate; conidia brownish, ovoid to globose, 12–22 $\times$ 10–16 μ; oöspores not seen.

The type on *Acalypha virginica* L., Madison, Wisconsin, Sept. 30, 1915, *T. T. Davis.*

This species is not to be confused with any other on euphorbiaceous hosts, as the others are all undoubted members of the genus *Peronospora*. Its nearest ally is *R. illinoisensis* (Farlow) Wilson, from which it differs in its more pronounced discoloration of the host; the larger conidiophores, which branch more; and the shorter apical branchlets. The conidia are very similar, both in size and form. It is also quite similar to *R. australis* (Speg.) Wilson, from which it differs in having more delicate conidiophores and larger conidia. The apparent dead spots on the host are rather remarkable, as they are by no means common in this group of fungi.

For those who follow Saccardo, this species may be designated as **Plasmopara Acalyphae** Wilson.

KANSAS ACADEMY OF SCIENCE,
LAWRENCE, KANSAS.

NOTES AND BRIEF ARTICLES

Mr. Worthington G. Smith, celebrated for his illustrations of British fungi, died November 1, 1917. Several other famous mycologists died last year, among them Dr. P. A. Karsten, of Finland; Dr. Paul Hariot, of France; Professor George Massee, of England; and Dr. Charles H. Peck, of America.

At a recent meeting of the Torrey Botanical Club, Dr. W. A. Murrill spoke of his investigations of the gill-fungi of tropical North America, which he has just completed, the final paper on this subject appearing in the March number of *Mycologia*. Some of the larger genera were mentioned and the number of species in them compared with those of temperate regions. Of the 525 tropical species recognized by Dr. Murrill in his studies, 300 have been described by him as new.

The poplar canker, *Dothichiza populea,* was very destructive last year. This disease was introduced from Europe several years ago, and is now quite widely distributed in New York and New Jersey, as well as elsewhere. The tree most seriously affected is the Lombardy poplar, although the Carolina poplar suffers considerably. No remedy has been found. The best means of checking the disease consists in cutting and burning affected trees as soon as they are discovered and in keeping a careful watch over nursery stock.

The structure of *Polyporus glomeratus* Peck was described and illustrated in the November number of *Torreya* by Overholts, who concludes that it is eminently worthy of specific rank. The author gives a good description of the species and states that it is known from New York, Ohio, and Michigan, on logs of maple and beech.

A list of the 1,108 water-color drawings of fungi by the late George E. Morris in the Peabody Museum of Salem, Massachusetts, has recently been prepared and published under the authorship of Albert P. Morse. A brief account of Mr. Morris's life and work is given in the introduction to this paper.

The botanical work of Ezra Michener was outlined by Shear and Stevens in an article in the December number of the *Torrey Bulletin*. The following paragraph is quoted from a description of the Michener herbarium, the fungi of which are now in Washington.

"In addition to portions of many of Schweinitz's specimens, as described in an earlier paper, the Michener herbarium contains numerous specimens from the collections of fungi described by Berkeley and Curtis as well as fungi identified by Michener himself. With the exactness characteristic of all his work Michener indicated on the labels the source of the specimen and by whom it was identified. This collection of fungi which has now been made available for study will prove of great value to American mycologists. The herbarium also contains an excellent collection of lichens, with many authentic specimens from Tuckerman, who identified most of the material."

The War Emergency Board of the American Phytopathological Society, which was organized at the Pittsburgh meeting during the holidays, held a meeting in Washington, February 9–11. The organization of this board is the result of a determination on the part of plant pathologists to do their part in winning the war. Certain problems of nation-wide importance are being handled. At the special meeting, reports on these projects were made. A census of all persons able to do pathological work is being taken and encouraging progress was noted. Other projects on Fungicides and Machinery, Emergency Research, Plant Disease Survey, and Crop Loss Estimates were considered at some length. Plant pathologists have in the war conditions a great opportunity for service to the commonwealth, for there is no more vital feature in maintaining maximum crop production than that of the reduction of leakage due to crop diseases.

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M.E. Eaton

MYCOLOGIA

VOL. X JULY, 1918 No. 4

ILLUSTRATIONS OF FUNGI—XXIX

WILLIAM A. MURRILL

The smaller gill-fungi are usually difficult to determine because the species are numerous and lack conspicuous distinctive characters. Those shown on the accompanying plate, which is the work of Miss Eaton, represent *Marasmius, Prunulus, Gymnopus,* and other genera. None of them are large enough to be of economic importance. Specimens of *Marasmius* have been determined by Professor L. H. Pennington.

Prunulus viscidipes Murrill, sp. nov.

Mycena viscidipes Murrill

VISCID-STEMMED PRUNULUS

Plate 8. Figure 1. × 1

Pileus hemispheric to expanded, becoming somewhat depressed at the center, gregarious to subcespitose, 1–2 cm. broad; surface hygrophanous but not viscid, glabrous, distinctly striate, fuliginous on the disk, pale-avellaneous to almost white toward the entire, straight margin; context exceedingly thin, pallid; lamellae arcuate-subdecurrent behind, ventricose in front, pallid, entire; spores ellipsoid, smooth, hyaline, 6–7 × 4μ; stipe slightly tapering upward, dull-gray, glabrous above, tomentose below, very viscid, 4–5 cm. long, 1.5–2.5 mm. thick.

Type collected by W. A. Murrill among leaves and sticks on the ground in deciduous woods in the New York Botanical Garden, July 30, 1915. Known only from the type locality. This is a dainty little plant with brownish, striate pileus and viscid stipe. It seems to have a preference for oak leaves.

[MYCOLOGIA for May (10: 107–176) was issued June 7, 1918.]

Laccaria amethystea (Bull.) Murrill

AMETHYST LACCARIA

Plate 8. Figure 2. × 1

Pileus thin, broadly convex, umbilicate or centrally depressed, solitary or gregarious, 1.2–2.5 cm. broad; surface hygrophanous, brown or violaceous-brown when moist, grayish when dry, unpolished; lamellae subdistant, adnate or decurrent, violaceous, color more persistent than in the pileus; spores globose, verruculose, 8–10 μ; stipe slender, equal, flexuous, hollow, concolorous or paler, 2.5–5 cm. long, 2–4 mm. thick.

This beautifully colored plant occurs sparingly on damp ground in shaded places throughout eastern temperate North America and in Europe. The specimens figured were quite small, only half the usual size of the species, which has been considered by some a variety of *L. laccata*.

Leptoniella conica Murrill, sp. nov.

Leptonia conica Murrill

CONE-SHAPED LEPTONIELLA

Plate 8. Figure 3. × 1

Pileus conic, not fully expanding, gregarious to subcespitose, 1.5 cm. broad and 1 cm. high; surface glabrous, hygrophanous, very slightly striate, umbrinous, becoming fuliginous on drying; margin slightly paler, incurved when young, entire; context very thin, pallid, without odor but with a very sweet, farinaceous taste; lamellae adnexed, slightly ventricose, subcrowded, pale-rose-colored, concolorous and entire on the edges; spores oblong, decidedly angular, obliquely apiculate at the base, pale-rose-colored with a large shining nucleus, 10–12 × 5 μ; stipe slightly tapering upward, concolorous, smooth, glabrous except at the base, where it is finely whitish-mycelioid, solid or somewhat hollow, 4–5 cm. long, 2–3 mm. thick.

Type collected by W. A. Murrill in damp soil among sticks and leaves on the bank of the Bronx River in the New York Botanical Garden, July 27, 1915. Known only from the type locality.

Laccaria striatula Peck

STRIATULATE LACCARIA

Plate 8. Figure 4. × 1

Pileus very thin, submembranous, convex or nearly plane, gregarious, 12–20 mm. broad; surface glabrous, hygrophanous, buff-red and striatulate when moist, grayish or pale-buff when dry; lamellae broad, distant, adnate, pale-flesh-colored; spores globose or subglobose, verruculose, 11–13 μ; stipe slender, equal, fibrous, hollow, concolorous, 1.5–3 cm. long, 1–2 mm. thick.

This species was described in the third volume of *Mycologia* as a form of *L. laccata*. It occurs in damp places in the northeastern United States. The specimens here figured were collected in July, 1915, on a mossy bank in the New York Botanical Garden.

Prunulus galericulatus (Scop.) Murrill

Mycena galericulata (Scop.) Quél.

SHIELD-SHAPED PRUNULUS

Plate 8. Figure 5. × 1

Pileus submembranous, conic-campanulate to expanded, cespitose, 2–6 cm. broad; surface pale-grayish to grayish-brown, dry, glabrous; margin striate to the umbo; lamellae interveined, adnate with a decurrent tooth, white or flesh-colored; spores sphaeroid, hyaline, 8–10 × 4–6 μ; stipe rigid, smooth, polished, glabrous, tomentose at the base, white, yellowish, or brownish, the base fusiform, radicate, 5–10 cm. long.

A densely clustered species very common on logs and stumps in the northeastern United States as far west as the Rocky Mountains. It is one of the best known species in this difficult genus. About New York, it occurs abundantly on old oak and chestnut stumps.

Omphalopsis fibula (Bull.) Murrill

Omphalia fibula (Bull.) Quél.

PIN-SHAPED OMPHALOPSIS

Plate 8. Figure 6. × 1 and × 2

Pileus membranous, commonly convex or hemispheric and umbilicate, rarely conic, 3–20 mm. broad; surface glabrous, hygrophanous, striatulate when moist and varying in color from

orange to pale-yellow, sometimes with darker center, even and paler when dry; lamellae distant, arcuate, strongly decurrent, white or yellowish; spores ellipsoid, smooth, $4–6 \times 2–3\,\mu$; cystidia $35–40 \times 7–8\,\mu$; stipe long, slender, subconcolorous, glabrous, 2.5–5 cm. long, 0.5–2 mm. thick.

This little yellow agaric occurs commonly among moss in damp places and may be found from Canada to the West Indies and west to Colorado and Honduras, as well as in Europe. The specific name refers to the very slender stipe, surmounted by the dainty cap, which suggests the head of some sort of pin.

Clitocybe farinacea Murrill

FARINACEOUS CLITOCYBE

Plate 8. Figure 7. × 1

Pileus convex, umbilicate, rather thin, gregarious, 2–3.5 cm. broad; surface smooth, glabrous, hygrophanous, very pale avellaneous; margin entire or undulate, concolorous, becoming inflexed and often crenate on drying; context thin, whitish, strongly farinaceous both in odor and taste; lamellae short-decurrent, determinate, arcuate, of medium distance when fresh but rather distant when dry; spores ovoid, smooth, hyaline, $6–8 \times 3–5\,\mu$; stipe equal, fleshy but more or less flexible, with a rather tough rind, pallid, smooth, pulverulent at the apex, nearly solid, 3–4 cm. long, 2–4 mm. thick.

Known only from the vicinity of New York City, where it occurs on rich soil in deciduous woods. The type specimens were found in the New York Botanical Garden in August, 1915. The taste of the fresh plants is extremely farinaceous.

Marasmius dichrous Berk. & Curt.

TWO-COLORED MARASMIUS

Plate 8. Figures 8 and 11. × 1

Pileus subfleshy, convex, at length plane or depressed, 2–4 cm. broad; surface not polished, dry, nearly smooth to rugose-striate, reddish or purplish-pallid to alutaceous, becoming brown in dried plants; lamellae adnate, often becoming nearly free, close, narrow in front, often crisped, pale-reddish; spores often guttulate, $8–10 \times 4.5–5\,\mu$; stipe short, hollow, thickened upward, reddish-pallid, brown, or dark-reddish-brown, pruinose or slightly pubescent at the subtuberculose base, 1–3 cm. long, 2 mm. thick.

This species occurs on twigs, bark, and wood in woods from New England to South Carolina and west to the Central States. The specimens figured were collected by W. A. Murrill in the New York Botanical Garden. Number 8 occurred on fallen sticks in deciduous woods, on July 29, 1915, and number 11 was found growing on the trunk of a living white willow, on August 9, 1915.

Marasmius insititius Fries

INSERTED MARASMIUS

Plate 8. Figure 9. × 1

Pileus membranous, convex to plane or subumbilicate, 6–12 mm. broad; surface not polished, pale-yellowish-brown, then whitish; margin becoming plicate-sulcate; lamellae unequal, simple, broadly adnate, distant, narrow in front, pallid; spores $4 \times 2.5\,\mu$ (Massee); stipe inserted, horny, hollow, reddish-brown, floccose-furfuraceous, 2–3 cm. long, 1 mm. thick.

This species is found on dead leaves and twigs from New York to North Carolina and west to Minnesota and Missouri; also in Europe. The specimens figured were collected on dead leaves in hemlock woods in the New York Botanical Garden, July 27, 1915, by W. A. Murrill.

NEW YORK BOTANICAL GARDEN.

STUDIES IN THE GENUS GYMNOSPORANGIUM—III. THE ORIGIN OF THE TELEUTOSPORE

B. O. Dodge

(With Plates 9–11)

The manner in which the teleutospores are formed in the rusts has been described by a number of authors, but our knowledge of the origin and development of the teleutospore in *Gymnosporangium* is based mainly on the work of Sappin-Trouffy,[1] Blackman,[2] and Reed and Crabill.[3] Blackman makes the following statement regarding the origin of the spores in *G. clavariaeforme:* "The teleutospores of this form are not borne on the mycelium but arise from comparatively rectangular cells which form a close-set layer on the surface of the mycelium at the points where the teleutospores are developed. . . . They are similar to the teleutospore-bearing cells described by Sappin-Trouffy for *G. Sabinae*. . . . Each of these cells gives origin to a number (not more than three or four) of narrow outgrowths which develop into the stalked two-celled teleutospores."

Reed and Crabill find that in *G. macropus* the teleutospore is formed by the budding of the upper cell of the pseudoparenchyma. "A layer of erect rectangular cells arises from this mycelial mass just beneath and perpendicular to the cortex. These cells elongate and their tips take on gradually the characters of the incipient teleutospores."

Weimer[4] has studied spore development in *G. macropus* and

[1] Sappin-Trouffy, P. Recherches histologiques sur la famille des Urédinées. La Botaniste **5**: 59–244, *f. 1–60*. 1896.

[2] Blackman, V. H. On the fertilization, alternation of generations and general cytology of the Uredineae. Ann. Bot. **18**: 323–373. *pl. 21–24*. 1904.

[3] Reed, H. S., and Crabill, C. H. The cedar rust diseases caused by *Gymnosporangium juniperi-virginianae* Schw. Virginia Agr. Exp. Sta. Tech. Bull. **9**: 1–106. *f. 1–23*. My 1915.

[4] Weimer, J. L. Three cedar rust fungi, their life histories and the diseases they produce. Cornell Agr. Exp. Sta. Bull. **390**: 509–549. *f. 136–157*. My 1917.

G. globosum and apparently agrees with Reed and Crabill regarding the first species. "From these stromatic layers the telispore stalks arise." Of *G. globosum* he says: "The telial horns are developed from a stromatic layer in the same manner as are those of *G. juniperi-virginianae*." Weimer's figure 156 shows a mature sorus of *G. clavipes*. At the margin teleutospores are figured arising directly from the outermost cells of the pseudoparenchyma.

If we use the term basal cell in the usual sense, that is, to designate the cell from which various spore forms take their origin, then, according to the authors cited above, the basal cell in the teleutospore sorus is the upper or terminal cell of the pseudoparenchyma or stromatic mass. The writer[5] has recently described the origin of the teleutospore in *G. transformans* and *G. fraternum* and has since studied this question in *G. macropus*, *G. globosum*, *G. clavariaeforme* and *G. nidus-avis*. In all of these species at least the true basal cell is not the upper cell in the chain but it is the penultimate cell from which the teleutospore arises by budding. In *G. transformans* and *G. fraternum* the upper cells increase in size considerably, lose their cytoplasm and nuclei by degeneration, and become mere bladdery sacs several times their original length, so that the epidermis is raised further and finally broken open. The penultimate cell then grows out through or between the buffer cells, forming a narrow bud from which the teleutospore is formed by further growth. In *G. transformans* the buds seem to grow up very quickly so that the formation and degeneration of the terminal cells may be overlooked. In *G. fraternum*, however, the buffer cells form a striking palisade layer which frequently extends clear across the sorus primordium.

MATERIAL AND METHODS

Some of the material used in these studies was obtained from plants artificially infected in the greenhouse. In most of the work material from naturally infected plants was also studied. It has

[5] Dodge, B. O. Studies in the genus *Gynosporangium*—I. Notes on the distribution of the mycelium, buffer cells and the germination of the aecidiospore. Brooklyn Bot. Gard. Mem. 1: 128–140, *pl. 1* × *f. 1–5*. My 1918.

been found that these rusts developed perfectly normally on plants kept in the greenhouse during the summer and placed in cold frames over winter. Very good results have been obtained by fixing extremely thin free-hand sections of material in Flemming's weaker fluid. It is necessary to orient the pieces accurately in order to avoid cutting oblique microtome sections of the buffer cells and teleutospore buds. Flemming's triple stain was used, and when the Orange G in concentrated aqueous solution is employed the buffer cells can be seen very distinctly; whereas if the other colors predominate, the walls of these large empty cells do not show up conspicuously. Sections were cut 10 μ thick.

GYMNOSPORANGIUM MACROPUS

Cedar apples were obtained from plants growing at Cold Spring Harbor, N. Y., November 30, 1917. The cedars were potted and some were placed in cold frames, others were kept in the greenhouse and two were planted in the garden. Galls from artificially infected cedars were also studied and R. C. Faulwetter sent me a large collection from Clemson College, S. C., in January.

Reed and Crabill (l. c.) describe in considerable detail the growth of the galls caused by this rust. They also studied the growth and appearance of the hyphae in their relation to cells and tissues of the host, and followed the development of the sorus from the early stages. My attention has been focused particularly on the method of the origin of the teleutospore and it is on this question in the main that I am unable to agree with Reed and Crabill. One or two other points may be noted, however. These authors had some difficulty in staining the mycelium to show cross-walls and nuclei of haustoria distinctly. I find that the septa appear very plainly in my preparations and the haustoria take a very delicate stain showing the single nucleus in each, or two nuclei when two are present. Neither do I find that the cortical layer is noticeably thicker over the pits in the galls at points where sori are to appear. Weimer believes that the formation of these pits is due to the inhibition of the growth of certain parenchyma cells by the fungus present, while at other points the cells continue to multiply so that depressions result. I find that the

parenchyma cells in the region between the pits are larger than are those beneath the depressions. This might bring about the formation of the pits. Pits are not formed in galls caused by *G. globosum*, and in most species of this genus the host cells with which the hyphae are associated are usually hypertrophied. In some cases pits are formed in galls before there is any massing of the mycelium in preparation for the formation of a sorus, and I have not noticed any great destruction or crushing of parenchyma cells of the host in early stages of sorus formation as stated by Reed and Crabill.

Hyphae were quite commonly present in the parenchyma of all parts of the galls fixed November 30, but they were in much greater abundance in the region beneath the depressions. In the least matured specimens the hyphae had just begun to push in between the outer and smaller parenchyma cells directly beneath the central part of a depression. Later stages show that these hyphae begin to branch (Pl. 9, Fig. 1) and become fairly definitely directed. The cells are slightly larger than the cells of the vegetative hyphae. Their nuclei are very conspicuous, both visible, lying on the long axis of the cell. Although the ends of the branches do not appear to be pushing strongly against the cork layer above, a small space now exists between the cork and the parenchyma of the host. As these hyphae branch and new cells are added, a quite definite loose palisade of radially directed hyphae is formed, the cells of which are somewhat longer than broad. The hyphal mass becomes more compact so that a pseudoparenchyma is formed with cells more or less rectangular or polyhedral in shape. The two nuclei now occupy various positions in the cells (Pl. 9, Figs. 2, 3). The upper cells grow against the cork layers and become somewhat flattened but they are usually slightly longer than the cells beneath. They soon begin to swell or elongate, their cytoplasm becomes more vacuolate and the nuclei take the safranin stain, while the nuclei of all the cells below take the gentian violet. The buffer cells finally become two or three times their original length and contain only a thin watery substance that is faintly colored with orange G. Their walls become thinner and thinner and finally disappear altogether. The

cork cells have been pushed up, crushed in or broken down. This disorganization may not be entirely due to pressure. The fungus evidently brings about some chemical changes in the suberized cells. After the buffer cells have lost their contents the cells below bud out, their nuclei move up to the base of the buds and divide. There are now two nuclei in the bud and two in the basal cell. A septum is formed at once. The young binucleated teleutospore bud grows comparatively slowly so that these stages are fairly abundant at the center of the young sorus (Pl. 9, Fig. 3). Buds may push out of the side of a basal cell (Pl. 9, Fig. 2) and later three or four buds may be formed from one cell. The cork layer is lifted up and broken open first at the central part of the pit. Mature spores are present when this slight swelling or blistering is first noticeable (Pl. 9, Fig. 4). The cells of the lower portion of the stromatic mass do not stain very readily, so that their nuclei do not appear distinctly. Reed and Crabill's diagram (l. c., Fig. 7) of a sorus, while it perhaps exaggerates somewhat, brings out the point that the spores push up rapidly from a region in the center of the depression, and further development peripherally is considerably retarded. The size of the papilla at the center of a depression in the gall determines roughly the diameter of the sorus as it emerges. At the center of the blister the cork cells, especially the innermost cells, are considerably disorganized and crushed in, and nearly mature spores have been formed. Near the margin many long two-nucleated spore buds are present. Buffer cells have disappeared in the whole region beneath the blister, but at its margin and immediately beyond for a short distance a different picture is presented. The cork cells have not been crushed in or lifted up so conspicuously, and buffer cells are plainly visible, fully elongated, and short buds, some without nuclei, are growing up from the basal cells. Figure 4 in plate 9 shows a portion of a young sorus at a time when the papilla is plainly visible but before the cork has been ruptured. The conditions near the margin of the blister are shown at the right in the figure. The sorus primordium ends rather abruptly just beyond. The diameter of the raised portion is about one half of the entire depression in this section. Figures 1 to 4 show the

general features of small portions at the center of young sori. Various stages in the degeneration of the terminal cells will be described in connection with the discussion of the next species, where the conditions are practically the same.

GYMNOSPORANGIUM GLOBOSUM

The best material was obtained at Cold Spring Harbor, November 30. The location of the primordia could not be determined definitely on this date, as the sori had not even begun to form. The rust was therefore allowed to develop further in the greenhouse until December 16. The young sori could then be located by the appearance of mound-like swellings over which the cork layer was tightly stretched. The covering was as yet unbroken. Sections of such a swelling showed a broadly elliptical sorus primordium, at the center of which teleutospore buds were plainly visible. Sori began to break through the surface about ten days later and by the middle of January the large telia had developed quite normally.

The cork layer covering the galls is somewhat thicker than we find in the galls caused by *G. macropus*. There are usually five to eight layers of irregular cork cells and the outer ones may be more strongly suberized. The parenchyma cells are well supplied with starch, and haustoria are present, although not in considerable numbers. There is usually a single nucleus in each haustorium. The earlier stages in the formation of the sorus are similar to those described in connection with the preceding species. There is a more pronounced massing of the hyphae and the pseudoparenchyma is more compact (Plate 10, Fig. 5).

In *G. globosum* the development of the sorus is evenly progressive. At the margin the hyphae are crowded in between the outer parenchyma cells, lifting up the cork layer slightly. Further in the pseudoparenchyma is well formed with terminal cells pushed up squarely against the cork layer. Figures 9 and 10 in plate 11 were drawn from different portions of a section through a sorus. Figure 9 shows the condition at the margin, which is abnormally high in this section, due to an irregularity in the gall. Figure 10 represents a more mature condition toward the center.

A great many different stages can be found in the two regions figured. The sorus has about reached its maximum width and very little marginal extension will occur. In the region at the left between *a* and *b* the growth of the hyphal mass has not been completed. At *b* the terminal cell appears to have begun to degenerate, to judge by the condition of its nuclei. The subterminal cell of this hypha is rather long for a basal cell and no doubt another cell will be cut off. From *c* to *d* terminal growth has been completed, so that the buffer cells can be recognized; they have begun to elongate and their nuclei are seen in the early stages of degeneration. In one cell the nuclei are breaking down. At *m* (below) the nuclei are degenerating without swelling. At *o, q* and *r* the degenerating nuclei look like poorly fixed division figures. There is a depression in the pseudoparenchyma at *f,* as though the cork cell above offered considerable resistance. The basal cells here are at a lower level. Growth certainly was not as vigorous at this point for some reason. At *q* and *r* very long buffer cells still persist in a region where spores are being matured. The whole primordium is quite a compact mass of cells wedged up under the cork.

Stages similar to those shown from *d* to *g* in the upper figure were found for a considerable distance along the section. A region in which most of the basal cells have begun to bud out is shown in the lower figure. At *h* the bud has pushed into the empty terminal cell. The nuclei have not yet begun to divide. At *p* two adjacent cells have somewhat longer buds and the nuclei are dividing conjugately. At *k* nuclear division has been completed and the four nuclei appear to lie well up in the tube. This bud is not within the buffer cell but is bent downward so that the septum if formed is not visible. At *i* there are two buds from the same cell, one of them is growing out between two buffer cells. Several other similar stages can be seen in the figure. The two nuclei are dividing in an older bud in the region near *s,* where two-celled buds and two-celled spores are also shown. The nuclei in the cells of the larger spore are just fusing. The cork layers above are not yet completely broken open at this point. Undoubtedly the further elongation of spore stalks will be a factor in completing the rupture.

With the gradual increase in size of the cells as we pass from the margin we find a corresponding enlargement of the nuclei, although there is considerable variation in this respect. At the margin the nuclei are small and spherical or elliptical in outline. Pear-shaped nuclei or nuclei with beak-like extensions are often found in the older cells. The terminal cells do not necessarily form a perfectly even layer. Some cells extend much beyond others. This is due to the inequality in the rate of growth, and perhaps to the fact that some of the cork cells give way more easily. The gall is often irregular in outline.

Having shown that the leaf forms of *Gymnosporangium* on *Chamaecyparis,* and the two cedar apple rusts on the red cedar develop their teleutospores from subterminal basal cells, we may next consider *G. clavariaeforme* which ordinarily inhabits the stem of the common juniper.

GYMNOSPORANGIUM CLAVARIAEFORME

Artificially infected junipers furnished the basis for the study of *G. clavariaeforme.* Sori in several stages of development were found January 17 in the stems of small plants ten days after they had been taken from the cold frame. The cork covering these young stems was not thick enough to cause any serious trouble in fixing or sectioning. Sappin-Trouffy and Blackman studied the origin of the teleutospore in this species and found as previously noted that the terminal cells of the hyphal mass give rise directly to buds from which spores will develop. A brief examination of my material was sufficient to show that such is not the case. The method of origin here is just the same as it is in the species which I have discussed above. The sori on the stem present very much the same picture as do those of *G. globosum* and it is unnecessary to go into details further than refer to figures 6 and 7 in plate 10 which show small portions of a young sorus, one near the margin, the other toward the center. In the first figure we see that the hyphae have pushed up against the cork layers, the end cells have become flattened and rectangular in shape. There is then the same characteristic elongation and degeneration of these terminal cells, and buds grow out from the

subterminal cells and form the teleutospores. Some of the young buds coming against the cork cells are bent sidewise or even downward because the cork layer has not as yet been sufficiently raised (Fig. 7). This figure shows three buds in which the two nuclei are dividing. As Blackman has published good figures of the later stages, no further study was made of spore formation.

GYMNOSPORANGIUM NIDUS-AVIS

The three stem forms, *G. nidus-avis, G. clavariaeforme,* and *G. clavipes* sometimes develop sori on the blades of leaves. A comparison of such leaf sori in the three species discloses interesting differences in the way in which the primordium develops. The first two species develop mycelium in all parts of the leaf, the hyphae ramifying among the wood cells. *G. clavariaeforme* causes a considerable enlargement or hyperplasia, *G. nidus-avis* induces some enlargement of individual cells of the leaf, but the total effect is not very striking. *G. clavipes* forms a sorus which is very superficial and the mycelium is very much localized.

The material that was used in the study of *G. nidus-avis* was taken from artificially infected plants, nos. 929 and 609, and from naturally infected plants where the sori develop on rather conspicuous gall-like mounds beneath the cork. The sorus is formed in much the same way as we found in *G. clavariaeforme.* The cork may be somewhat thicker in the specimens examined and the pseudoparenchyma even more extensively developed and compact. Figure 8, Pl. 10, shows the marginal region of a sorus, the main part of which had already developed mature spores. The terminal cells begin to degenerate before they elongate very much. Their nuclei are often smaller than are those of the basal cells at this stage. All cells of the primordium are more or less rectangular and are closely crowded together. At the right in the figure one basal cell has budded out laterally and another has pushed into the buffer cell. Other stages are similar to those described in the preceding species.

CONCLUSIONS

The origin of the teleutospores from the subterminal cells of the tissue composing the primordium has been shown to be a very

common method in this genus of the rusts. The hosts attacked by the six species studied represent three species and two genera of conifers. The epidermis of the leaves and young stems is rather heavily cutinized, and the galls or stems upon which the sori of some of the species develop are covered with layers of cork of considerable thickness. After the cork (or epidermis) has been lifted up or broken open and the pressure on the marginal hyphal mass has been removed we might expect to find that the later-formed spores (at the margin) arise directly from the terminal cells. If the terminal cell becomes disorganized in response to a particular need for some sort of space-making unit it would not be necessary for every terminal cell in the primordium to degenerate. It is sometimes difficult to ascertain just how the spores are formed at the margin of a nearly full-grown sorus. I have as yet found no evidence that they arise at any time from terminal cells. It is not expected, of course, that this rule will apply to all other species of *Gymnosporangium*.

If the terminal cell represents a morphological unit in the primordia of the rusts, a unit not a basal cell, but one having either the space-making function or some unknown function we ought to find such units in other genera. The presence of sterile tissue in the accidium primordium in addition to the sterile cells above the gametic cells has been noted by those who have studied this spore form. The morphological or phylogenetic significance of these peculiar cells certainly has not been overemphasized, and it would be interesting to know just to what extent space-making requirements could lead to degeneration of tissue in the primordia of all spore forms, uredo sori and spermogonia included.

COLUMBIA UNIVERSITY,
NEW YORK CITY.

EXPLANATION OF PLATES

The drawings were made with the aid of the camera lucida. Zeiss No. 4 eyepiece and 1/12th oil immersion lens were used in making Figs. 1, 2, 4–8. No. 5 eyepiece was used for Figs. 3, 9 and 10. Reduction about one fourth for Plates 10 and 11 and about one third for Plate 9.

PLATE 9, *Gymnosporangium macropus*

Fig. 1. Beginning of a sorus primordium at the center of a depression or pit in the gall.

Fig. 2. Older stage. About one third of the primordium is shown here. Further extension is being made at the left. Degenerating terminal cells are shown at the center, and spore buds are pushing into or between buffer cells at the right. The nuclei are just dividing in one bud. The walls of the overlying cork cells at the right are being pushed in.

Fig. 3. At the center of another young sorus. Shows that some terminal cells disintegrate more quickly than others. The position of the nuclei in a young bud just prior to division can be seen at the left. The cork cells are very irregular and are somewhat distorted by pressure.

Fig. 4. A portion of an older sorus at the stage when the papilla is quite noticeable. Two cork cells (at the left) are completely broken up and spores are nearly mature. Two or three spores or spore buds arise from each basal cell. No traces of buffer cells can be seen. At the right of the cells bearing two-celled spores there are six or seven basal cells that bear spore buds in which the stalk cell of each has just been cut off. There are one or two buds having three cells. The next region shows two-nucleated buds and other buds just forming. Traces of buffer cell walls are now visible as mere lines. At the right in the figure the degenerating terminal cells are very distinct. This figure shows the conditions near the border of the blister-like swelling. Note the abrupt transition here, practically all stages in spore formation from those in which the terminal cells still possess nuclei to the stages where two-celled spores are completed.

PLATE 10

Fig. 5, *Gymnosporangium globosum.* The central portion of a young primordium. Terminal cells have elongated slightly but have not begun to degenerate. The nuclei are somewhat larger than are those in the primordium of *G. macropus.*

Fig. 6, *Gyymnosporangium clavariaeforme.* The region at the margin of a young sorus at the center of which spores are just beginning to form. The cells from which the spore buds arise are plainly at a lower level than the terminal cells at the left. The host cells contain masses of some deeply staining substance showing degeneration, but their nuclei appear to be quite normal. An haustorium is shown in one cell.

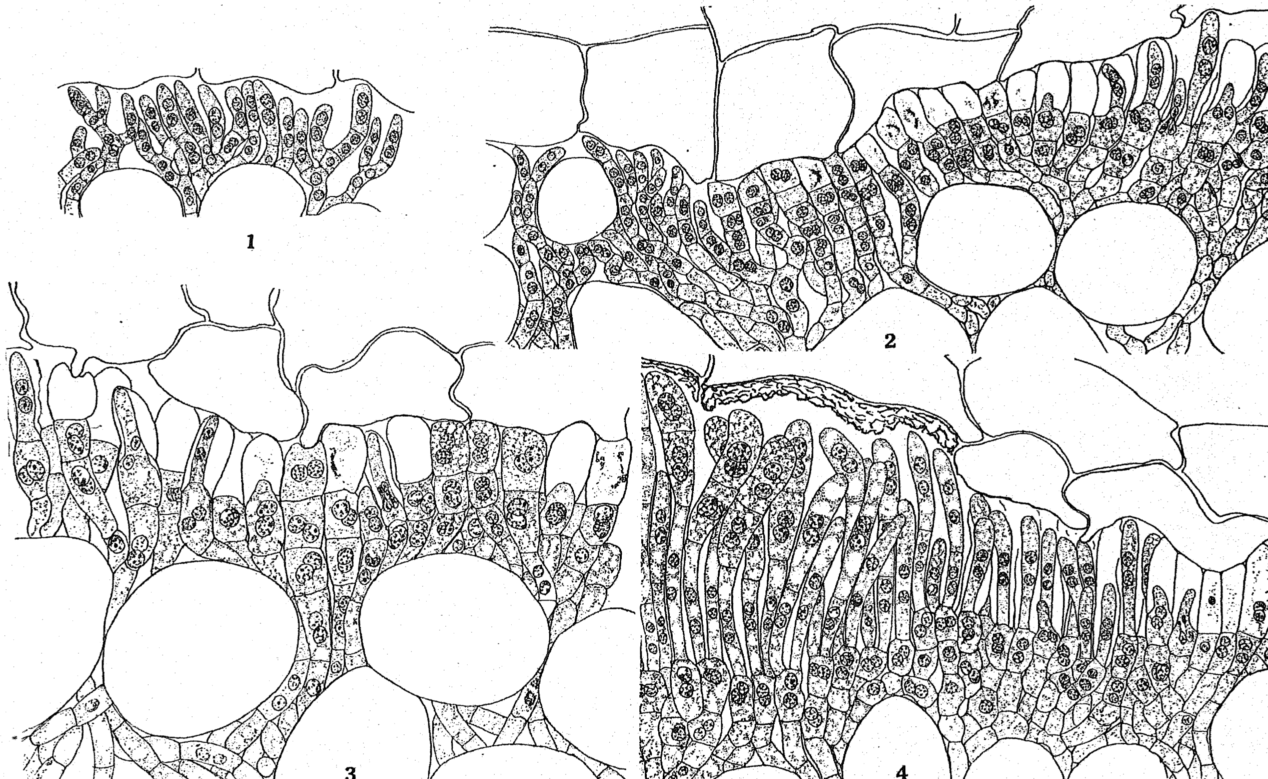
Fig. 7, *Gymnosporangium clavariaeforme.* Region at the center of a younger sorus. In one cell a bud is just forming. Nuclear division is occurring in the buds from three adjacent subterminal cells, one of which also has a bent two-nucleated lateral bud.

Fig. 8, *Gymnosporangium nidus-avis.* Near the margin of a large sorus on a naturally infected plant. Mature spores were present at the center and the cork had just been ruptured. There were about fifteen rows of flattened thick-walled cork cells above the region shown in the figure.

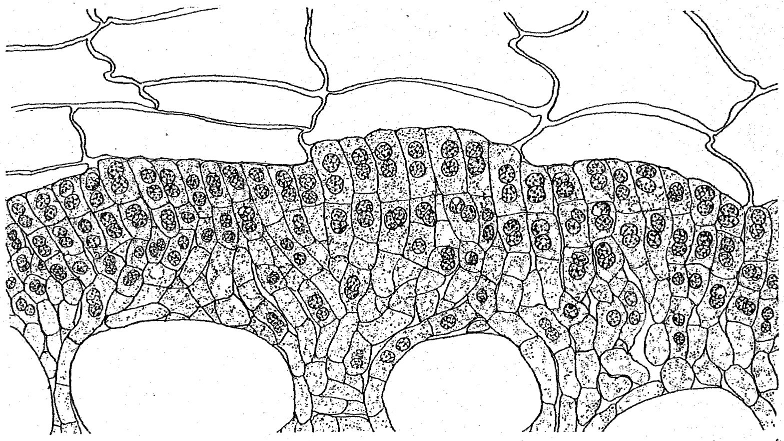
The nuclei of the terminal cells are small, and degeneration is not preceded by such an amount of elongation as occurs in the other species. A lateral bud and an internal spore bud are shown at the right. The nuclei of the cells of the pseudoparenchyma are rather large.

PLATE 11

Figs. 9 and 10, *Gymnosporangium globosum.* The upper figure shows the conditions from the margin of a sorus inward. The lower figure is drawn



GYMNOSPORANGIUM MACROPUS



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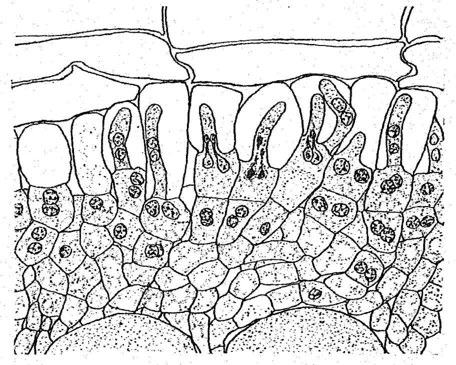

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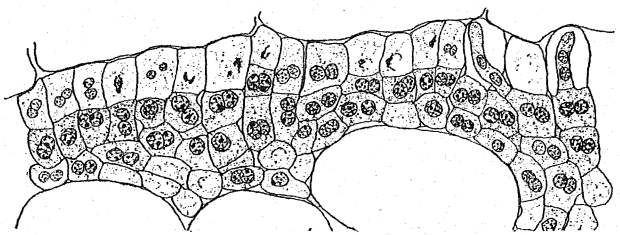

8

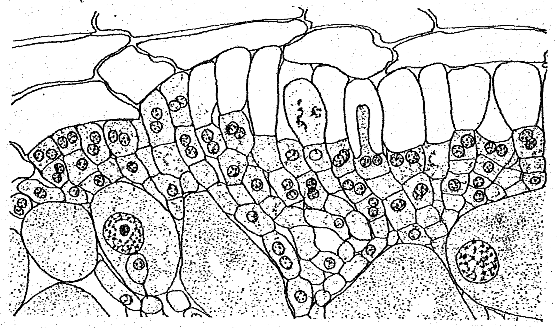

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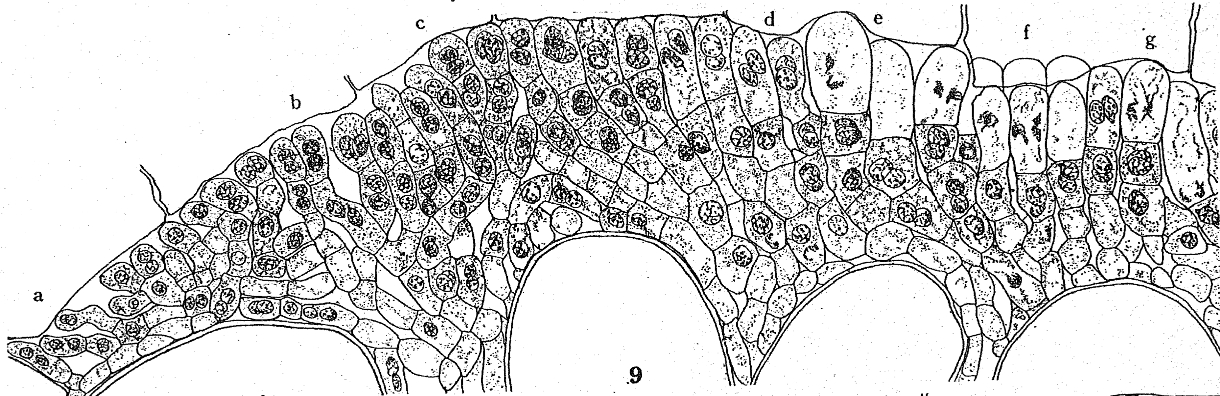
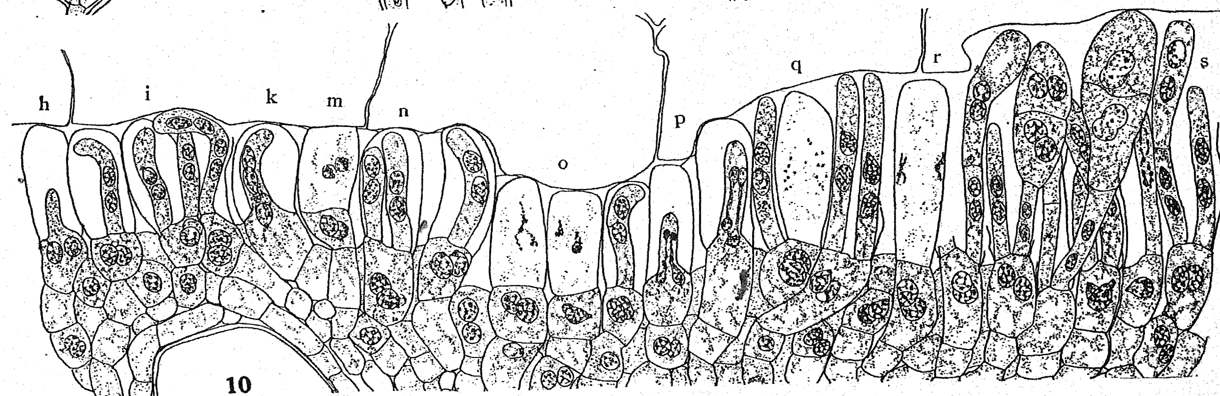
FIG. 5. G. GLOBOSUM. FIGS. 6, 7. G. CLAVARIAEFORME. FIG. 8. G. NIDUS-AVIS



9



10

GYMNOSPORANGIUM GLOBOSUM

from the same section but at about the center of the sorus. Between the two parts shown there is a space equivalent to about five or six times the amount shown in the figures. At *a* (Fig. 9) marginal growth is still continuing slowly. The nuclei in the terminal cell at *b* appear to be degenerating. The sorus is abnormally high at *c-d* due to an irregularity in the gall. Here the terminal cells have been cut off and their cytoplasm is becoming more vacuolated; *e*, first buffer cell that has lost both cytoplasm and nuclei; *f*, *g*, a depression in the primordium due to a less vigorous growth of the hyphal mass below; *m*, *o*, *q*, *r*, other terminal cells in various stages of degeneration; *h*, a basal cell just beginning to bud; *p*, conjugate division of the nuclei in young spore buds; *k*, nuclear division completed in a bud that pushes out laterally from the basal cell on its lower side, and the septum, if formed, is not visible because the bud bends down and is not within the terminal cell as it appears in the figure; *i*, *n*, *q*, *r*, two-nucleated buds cut off by septa from their basal cells; *s*, four-nucleated buds, nuclei of a two-nucleated bud dividing, two-celled spores, nuclear fusions, etc.

CULTURES WITH MELAMPSORAE ON POPULUS

JAMES R. WEIR AND ERNEST E. HUBERT

Additional cultural results with the *Melampsorae* on species of *Populus* have been secured since the positive results in 1916 on species of *Larix* with the rust known as *Melampsora medusae* Thüm. found on *Populus trichocarpa* and *P. tremuloides*.[1] The telial material on *P. tremuloides* used in 1916 was typical of *M. albertensis* Arth., but owing to the fact that positive results were secured on species of *Larix* only and negative results on *Pseudotsuga taxifolia*[2] is was referred to *M. medusae*.

In April, 1917, a large number of cultures were undertaken for the purpose of checking the two rusts commonly found on *Populus* in the Northwest. The aecial stage known as *M. albertensis* on *Pseudotsuga taxifolia* was found in July, 1916, at Darby, Montana, and at other points, but no successful check cultures had been made for this region up to the present report. The results of the 1917 cultures are presented in Table I. All cultures were made under control conditions in the greenhouse at Missoula, Montana, by the use of celluloid cylinders. An attempt was made to use only those hosts having young susceptible needles.

A study of the data in Table I shows that the sporidia of the rusts known as *M. albertensis* and *M. medusae* infect species of *Larix* and species of *Pseudotsuga* without any apparent preference on the part of either fungus for any particular host genus. Teliospores from a small portion of an infected leaf of collection No. 24 was used to inoculate both *Larix occidentalis* and *Pseudotsuga taxifolia* with positive results in both cases. This was done to eliminate so far as possible the chance of having two

[1] Weir, Jas. R., and Hubert, E. E. Recent cultures of forest tree rusts. Phytopath. 7: 106–109. 1917.

[2] The negative results on *Pseudotsuga taxifolia* in the light of recent work have since been attributed to the use of trial hosts with needles too far advanced in growth. It appears that the youngest and most tender needles are the most susceptible to infection.

species of *Melampsora* on leaves of the same host and included in one collection. In order to check the results obtained from sowing sporidia of *M. medusae* (collection No. 24) on *Pseudotsüga* species the aeciospores thus obtained were sown on young leaves of *Populus trichocarpa.* The leaves were inoculated May 18 and uredinia appeared June 8. Successful inoculations have been secured by sowing some of these urediniospores upon leaves of *Populus trichocarpa.* Inoculations were made on June 9, 1917, and on June 20 abundant uredinial sori were produced. This explains the great abundance of these rusts in regions of few aecial hosts. The proper conclusion of this culture will be to use the telial stage in producing the rust on *Larix.*

Aeciospores resulting from a successful inoculation with collection No. 57 on *Larix occidentalis* were sown June 29, 1917, on young leaves of *Populus trichocarpa.* Uredinia developed in abundance on July 7. No marked differences could be found between the uredinia and urediniospores of this culture and those resulting from an inoculation of *P. trichocarpa* leaves with aeciospores from *Pseudotsuga taxifolia.*

A careful study of the pycniospores and aeciospores resulting from the above cultures was made. These aeciospores on species of *Larix* and on species of *Pseudotsuga* were also compared with aeciospores on *Larix laricina* resulting from an inoculation with telia of *Melampsora medusae* from *Populus deltoides* and *P. tremuloides* cultured by Mains at Ann Arbor, Michigan, May 14, 1914 (N. A. U. No. *1121*). No important differences could be found in comparing the characteristics of these spores. Repeated attempts have been made to find evident differential characters by which the uredinia and telia of these two forms here considsidered may be plainly and readily separated, but with very little success. The first noticeable gross character of *M. albertensis* is that the telia appear to spread out like melted wax while those of *M. medusae* (Fig. 1) are more elevated and conspicuous. The former character of *M. albertensis* only holds good, however, where average-sized leaves of its most common host, viz., *Populus tremuloides* are infected. The rust has been repeatedly collected from large leaves from sprouts at the base of trees which

had all the gross characters of *M. medusae* although the average-sized leaves on the parent tree bore the typical form of the rust, *M. albertensis*. These same variations may be noted when the host is *P. trichocarpa*. In regions where the only possible aecial host is *Pseudotsuga taxifolia* the form *M. medusae* will exhibit the same gross variations on *P. trichocarpa* and *P. tremuloides*. It is equally difficult to try to separate the teliospores of these rusts microscopically. The fact that either of them will go on both *Pseudotsuga* and *Larix* irrespective of source or appearance of telia indicates that these rusts which were at first distinguished as *M. medusae* and *M. albertensis* are the different host manifestations of the same rust and should apparently be referred to *Melampsora medusae* Thüm.

Arthur in 1910[3] and in 1911[4] successfully inoculated *Pseudotsuga taxifolia* (*P. mucronata*) with the telial stage of *M. albertensis*, in every case securing negative results on *Larix* spp. As no statement is made regarding the age of the needles used in these inoculations we venture to suggest that the needles of the larches used may have been too old to become infected. This would undoubtedly be the case if the host trees used developed their needles at the same time that trees of similar spcies develop needles in the open. Observations in this locality show that the new needles of *Larix occidentalis* growing in the open were far enough advanced on May 8, 1917, to be susceptible to infection and on the same date the leaf buds of *Pseudotsuga taxifolia* were not even swelling. New susceptible needles of *Pseudotsuga* were not recorded in the open until May 28 and later June 8. On June 8 the aecial stage of the rust was found near Missoula, Montana, on *Larix occidentalis*, while adjacent trees of *Pseudotsuga taxifolia* were just forming new needles. The host trees, used in the inoculation experiments here recorded and kept in the greenhouse since the preceding two seasons, developed new needles at earlier dates than those recorded for similar trees in the open. In the majority of cases the newly-formed needles were the only ones on the trial host which became infected.

[3] Arthur, J. C. Cultures of Uredineae in 1910. Mycologia 4: 7–33. 1912.
[4] Arthur, J. C. Cultures of Uredineae in 1911. Mycologia 4: 49–65. 1912.

TABLE I

INOCULATION DATA FOR RUSTS ON POPULUS SPECIES

Collection No.	Inoculating Material.—Telia.	Locality of Telial Collection.	Species Inoculated.	No. Plants Inoculated.	Date Inoculation 1917.	Pycnia.	Aecia.	Degree of Infection.
8073	*Melampsora medusae* on *Populus trichocarpa*	Missoula, Montana	*Larix europea*	1	May 3	May 17	May 21	Medium
8073	Ditto	Ditto	*Pseudotsuga taxifolia*	1	May 8	May 18	May 23	Heavy
20	*Melampsora albertensis* on *Populus tremuloides*	Spokane, Wash.	*Larix occidentalis*	2	April 16	April 26	May 2	Heavy
20	Ditto	Ditto	Ditto	1	April 30	May 14	May 21	Heavy
20	Ditto	Ditto	*Larix europea*	1	April 26	May 8	May 14	Heavy
20	Ditto	Ditto	*Pseudotsuga taxifolia*	1	April 17	May 7	May 31	Heavy
20	Ditto	Ditto	Ditto	1	April 19	May 7	May 14	Heavy
20	Ditto	Ditto	Ditto	1	April 23	May 7	May 13	Very heavy
20	Ditto	Ditto	*Pseudotsuga macrocarpa*	1	April 21	May 12	May 19	Heavy
20	Ditto	Ditto	*Larix lyallii*	2	April 16	April 27	May 8	Heavy
20	Ditto	Ditto	*Tsuga heterophylla*	1	April 19	0	0	Negative
24	*Melampsora medusae* on *Populus trichocarpa*	Ditto	*Larix occidentalis*	1	April 26	May 8	May 17	Medium
24	Ditto	Ditto	*Larix lyallii*	1	April 27	May 14	No aecia	Medium
24	Ditto	Ditto	*Pseudotsuga taxifolia*	1	April 26	May 7	May 14	Heavy
40	Ditto	Darby, Montana	Ditto	1	May 18	May 29	June 2	Heavy
43	Ditto	Ditto	*Larix occidentalis*	1	May 18	May 29	June 3	Heavy
43	Ditto	Ditto	*Pseudotsuga macrocarpa*	1	May 17	0	0	Negative. Needles too old
49	*Melampsora albertensis* on *Populus tremuloides*	Pattee Creek, Missoula, Montana	*Larix occidentalis*	2	May 20	May 29	June 2–3	Heavy
49	Ditto	Ditto	*Pseudotsuga macrocarpa* (old needles)	1	May 20	—	—	No result. Needles too old
57	*Melampsora medusae* on *Populus trichocarpa*	Grant Creek, Missoula	*Pseudotsuga taxifolia*	1	June 11	June 20	June 26	Heavy
57	Ditto	Ditto	*Larix occidentalis*	1	June 11	June 20	June 24	Heavy
58	Ditto	Boulder, Montana	*Pseudotsuga taxifolia*	1	June 14	June 24	June 29	Heavy
58	Ditto	Ditto	*Larix occidentalis*	1	June 14	0	0	No result. Needles too old
33	*Melampsora albertensis* on *Populus tremuloides*	Darby, Montana	*Pseudotsuga taxifolia*	1	May 8	May 21	May 27	Medium

An interesting feature of the pycnial stage of the *Melampsorae* is a pronounced and characteristic odor evident at the time the pycnia are expelling spores. Exudations of a clear liquid also accompany this stage and are found to be sweet to the taste. These characters are possessed by the pycnial stage of a number of other forest trees and field plant rusts. The odor of the pycnial stage of *Melampsorella elatina* (A. & S.) Arth. on *Abies* spp., *Peridermium coloradense* (Dietl.) A. & K. on *Picea engelmanni*, and *Puccinia monoica* (Pk.) Arth. on *Arabis kochii* is particularly noticeable. The pycnial odor of the *Melampsorae* is fragrant, while that of *Peridermium coloradense* is decidedly offensive, approaching the odor given out by certain Nymphaeas.

SUMMARY

The results of the present investigation show that the rusts on *Populus* which were heretofore distinguished as *Melampsora medusae* and *M. albertensis* will infect both *Pseudotsuga* and *Larix*. In the absence of sharp differential characters between these two forms, both in their gross and minute details, it is suggested that they are the different host manifestations of the same rust and should apparently be referred to *Melampsora medusae* Thüm.

Two new hosts for this rust are recorded, viz., *Larix lyalli* and *Pseudotsuga macrocarpa*.

New and interesting features attending the production of pycnia in the *Melampsorae* are reported.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
MISSOULA, MONTANA.

NORTH DAKOTA FUNGI[1]—II

J. F. BRENCKLE

III. LOWER BASIDIOMYCETES

Aecidium Allenii Clint.
On *Elaeagnus argentea.* Kulm and Leeds, June, 1912, Lunell.
(Fungi Dak. *126.*)

Aecidium Boltoniae Arth.
On *Boltonia asteroides.* Kulm, June, 1911.
(Fungi Dak. *127.*)

Aecidium Convallariae Schum.
On *Polygonatum giganteum.* Leeds, July, 1913, Lunell.

Aecidium Compositarum Authors.
On *Ratibida columnaris.* Logan Co., July, 1912.

Aecidium Falcatae Arth.
On *Falcata comosa.* Washburn, July, 1915, Stevens.
(Fungi Dak. *326.*)

Aecidium Grindeliae Griff.
On *Grindelia squarrosa.* Kulm, June, 1909.
(Fungi Dak. *201.*)

Aecidium magnatum Arth.
On *Vagnera stellata.* Kulm, June, 1908.
(Fungi Dak. *1.*)

Aecidium Lilii Clint.
On *Lilium umbellatum.* July, 1913.

Aecidium Liatridis Ellis & Ander.
On *Liatris punctata, L. scariosa.* Kulm, June, 1910.
(Fungi Dak. *101, 401.*)

Aecidium Malvastri Arth.
On *Malvastrum coccineum.* Kulm, June, 1911.

Aecidium Hydrophylli Peck.
On *Hydrophyllum virginicum.* Fargo, May, 1915, Stevens.
(Fungi Dak. *302.*)

Aecidium Ranunculacearum DC.
On *Anemone cylindrica, Ranunculus sceleratus.* Kulm, June, 1908.

Aecidium Sommerfelti Johanson.
On *Thalictrum purpurascens.* Fargo, June, 1908, Seaver.

Aecidium Thalictri Chev.
On *Thalictrum thyrsoideum, T. Lunellii, T. vegetum, T. dasycarpum.* Leeds, Lunell, Fargo, Stevens; Kulm.
(Fungi Dak. *104.*)

[1] A few species are included from bordering counties in South Dakota.

Aecidium Violae Schum.
On *Viola sororia, V. papilionacea, V. scabriuscula, V. arenaria.* Fargo, 1915, Stevens; Leeds, Lunell and Kulm.
(Fungi Dak. *151.*)
Cintractia externa (Griff.) Clint.
On *Carex filifolia.* Kulm, June, 1909.
(Fungi Dak. *52.*)
Coleosporium Solidaginis (Schw.) Thuem.
On *Aster chinensis,* and *A. laevis.* Fargo, 1915, Stevens.
On *Aster paniculatus,* and *A. multiflorus.* Kulm, 1912.
On *Solidago canadensis, S. gilvocanescens,* and *S. Pitcheri.* Leeds, Lunell.
On *Solidago serotina, S. mollis.* Kulm, 1909.
(Fungi Dak. *77, 276, 276a, 305, 305a, 355, 355a.*)
Cronartium Comandrae Peck.
On *Comandra pallida.* Beaver Lake, Sentinel Butte, and Camp Crook, S. D.
(Fungi Dak. *78, 403.*)
Doassansia Alismatis (Nees) Cornu.
On *Alisma Plantago-aquatica.* Kulm, June, 1913.
(Fungi Dak. *202.*)
Doassansia Sagittariae (West.) Fish.
On *Sagittaria latifolia.* Kulm, July, 1914.
(Fungi Dak. *253.*)
Earlea speciosa (Fr.) Arth.
On *Rosa praticola, R. heliophylla,* and *R. blanda.* Kulm and Leeds.
(Fungi Dak. *53, 53a, 53b.*)
Entyloma Compositarum Farl.
On *Erigeron philadelphicum.* Valley City, 1884, Seymour.
Entyloma Menispermi Farl. & Trel.
On *Menispermum canadense.* Valley City, Seymour.
Entyloma Physalidis (Kalch. & Cooke) Wint.
On *Solanum triflorum.* Bismark, 1884, Seymour.
Gymnosporangium Betheli Kern.
On *Juniperus scopulorum.* Williston, 1915, Stevens.
On *Crataegus* sp. Williston.
(Fungi Dak. *331.*)
Gymnosporangium globosum Farl.
On *Juniperus prostrata.* Glen Ullin, July, Stevens.
(Fungi Dak. *332.* Not *332a.*)
Gymnosporangium Juniperi-virginianae Schw.
On *Malus ioensis,* and *Juniperus virginiana.* Fargo, 1915, Stevens.
(Fungi Dak. *358.*)
Gymnosporangium juvenescens Kern.
On *Amelanchier alnifolia,* and *Juniperus prostrata.* Williston, Glen Ullin, Sentinel Butte, 1915, Stevens.
(Fungi Dak. *278, 359, 359a.*)
Gymnosporangium Nelsoni Arth.
On *Juniperus scopulorum.* Williston, 1915, Stevens.
(Fungi Dak. 332*a.* Not *G. globosum* Farl.)

Melampsora Bigelowii Thüm.
On *Salix amygdaloides, S. candida,* and *S. longifolia.* Kulm, Leeds, and Fargo.
(Fungi Dak. *37, 176.*)
Melampsora Lini Desm.
On *Linum Lewisii.* Dore, Stevens.
On *Linum rigidum.* Dickenson.
On *Linum sulcatum,* and *L. usitatissimum.* Kulm.
(Fungi Dak. *235, 235a.*)
Melampsora Medusae Thüm.
On *Populus deltoides, P. tremuloides.* Kulm, 1909.
On *P. monilifera.*
(Fungi Dak. *79.*)
Nigredo appendiculatus (Pers.) Arth.
On *Phaseolus nanus.* Kulm, Sept., 1909.
(Fungi Dak. *87.* *Uromyces appendiculatus* (Pers.) Ung.)
Nigredo Eleocharidis Arth.
On *Eleocharis olivacea,* and *E. palustris.* Kulm, 1908.
(Fungi Dak. *50,* as *Uromyces Eleocharidis* Arth.)
Nigredo Fabae (Pers.) Arth.
On *Lathyrus venosus.* Fargo, Ft. Ransom, 1915, Stevens.
(Fungi Dak. *372.*)
Nigredo intricata (Cooke) Arth.
On *Eriogonum flavum, E. multiceps.* Sentinel Butte, Aug., 1916; Medora, 1884, Seymour.
(Fungi Dak. *406.*)
Nigredo Junci (Desm.) Arth.
On *Juncus balticus.* Kulm, Dec., 1910.
On *Ambrosia psilostachya, Circium Flodmanii, Helianthus Maximilliani,* and *H. tuberosus.* Kulm and Fargo.
(Fungi Dak. *20, 52* *Aecidium Cardui* Arth., *26* *Aecidium Compositarum* Mart., *45a.* *Puccinia Helianthus* Schw. *1, 350.*)
Nigredo perigynia (Halst.) Arth.
On *Carex abbreviata.* Leeds, June, 1912, Lunell.
Nigredo plumbaria (Peck) Arth.
On *Gaura coccinea.* Kulm, June, 1916.
Nigredo Polemonii (Peck) Arth.
On *Spartina Michauxiana.* Kulm, 1909.
On *Collomia linearis,* and *Steironema Lunellii.* Kulm, June, 1910.
On *Dodecantheon thornense.* June, 1914, Thorne, Lunell.
On *Vagnera stellata* (?). Kulm, 1911.
(Fungi Dak. *70, 102, 134, 259,* and probably *1.*)
Nigredo Polygoni (Pers.) Arth.
On *Polygonum aviculare, P. erectum.* Kulm, Oct., 1909.
(Fungi Dak. *72, 133, 133a.*)
Nigredo proeminens (DC.) Arth.
On *Euphorbia glyptosperma, E. stricticaulis,* and *E. serpyllifolia.* Kulm and Leeds, 1910, Lunell.
(Fungi Dak. *71, 71a, 119, 155, 177.*)

Nigredo punctata (Schroet.) Arth.
On *Astragalus adsurgens, Aragallus Lambertii, Homolobus caespitosus,* and *Orophaca caespitosa.* Kulm, Garrison, Sentinel Butte.
(Fungi Dak. *178, 373, 389.*)
Nigredo Scirpi (Cast.) Arth.
Scirpus fluviatilis, S. campestris, Sium cicutaefolium. Kulm, 1909.
(Fungi Dak. *120, 120a, 179, 374.*)
Nigredo Silphii (Burrill) Arth.
On *Juncus tenuis.* Kulm, 1908.
(Fungi Dak. *21.*)
Nigredo Trifolii (Hew.) Arth.
On *Trifolium pratense,* and *T. repens.* Kulm, Fargo, 1914, Stevens.
(Fungi Dak. *74, 283, 375.*)
Phragmidium americanum Arth.
On *Rosa blanda.* Kulm, July, 1908.
(Fungi Dak. *7.*)
Phragmidium Andersoni Shear.
On *Dasiphora fruticosa tenuifolia.* Sentinel Butte, Aug., 1916.
(Fungi Dak. *408.*)
Phragmidium imitans Arth.
On *Rubus strigosus.* Delaney's Ranch, Aug., 1915.
(Fungi Dak. *360.*)
Phragmidium montivagum Arth.
On *Rosa* sp. Sentinel Butte, Aug., 1916.
(Fungi Dak. *203.*)
Phragmidium Potentillae (Pers.) Karst.
On *Potentilla bipinnatifida, P. pennsylvanica.* Leeds, 1912, Lunell.
On *Potentilla pennsylvanica strigosa.* Kulm, 1907.
(Fungi Dak. *6, 180, 180a.*)
Phragmidium Rosae-acicularis Liro.
On *Rosa heliophylla.* Kulm, July, 1912.
(Fungi Dak. *181.*)
Phragmidium Rosae-arkansanae Dietel.
(Fungi Dak. *152, 182, 285, 362.*)
Pileolaris Toxicodendri (Berk. & Rav.) Arth.
On *Rhus radicans.* Kulm, June, 1908.
(Fungi Dak. *22.*)
Polythelis Pulsatillae (Rost.) Arth.
On *Pulsatilla hirsutissima.* Kulm, June, 1908.
(Fungi Dak. *129.*)
Polythelis Thalictri (Chev.) Arth.
On *Thalictrum dasycarpum.* Fargo, 1915, Stevens.
(Fungi Dak. *317.*)
Puccinia ambigua (Albert. & Schw.) Lagh.
On *Galium Aparine.* Beaver Lake, July, 1909.
(Fungi Dak. *59.*)
Puccinia amphigena Diet.
On *Calamovilfa longifolia.* Kulm, Oct., 1910.

On *Smilax herbacea.* Kulm.
(Fungi Dak. *80.*)

Puccinia amphibii Fuckel.
On *Polygonum emersum.* Kulm, Aug., 1908.
(Fungi Dak. *41.*)

Puccinia Andropogonis Schw.
On *Andropogon furcatus, A. Hallii,* and *A. scoparius.* Kulm and other places, also 1884, Seymour.
(Fungi Dak. *42, 315.*)

Puccinia Anemones-virginianae Schw.
On *Anemone virginiana.* Wild Rice, Aug., 1914, Stevens.
(Fungi Dak. *289.*)

Puccinia angustata Peck.
On *Scirpus atrovirens.* Kulm, Oct., 1909.
On *Lycopus americanus.*
(Fungi Dak. *105, 105a.*)

Puccinia apocrypta Ellis & Tracey.
On *Elymus canadensis.* Kulm, July, 1911.
(Fungi Dak. *128.*)

Puccinia Asparagi DC.
On *Asparagus officinalis.* Leeds, Sept., 1914, Lunell.
(Fungi Dak. *261.*)

Puccinia Asteris Duby.
On *Aster longifolius, A. multiflorus, A. Novae-Angliae,* and *A. paniculatus.* Kulm, Aug., 1908; Leeds, Sept., 1914, Lunell.
(Fungi Dak. *60, 290.*)

Puccinia atropuncta Peck & Clint.
On *Zygadenus elegans.* Kulm, Aug., 1909.

Puccinia Bartholomaei Diet.
On *Bouteloua oligostachya.* Kulm, Oct., 1913.
(Fungi Dak. *183.*)

Puccinia Caricis-asteris Arth.
On *Aster longifolius, A. multiflorus.* Kulm, Aug., 1909.

Puccinia cinerea Arth.
On *Puccinellia airoides* and *Oxygraphis Cymbalaria.* Kulm, June and Sept., 1912.
(Fungi Dak. *185, 185a.*)

Puccinia Cirsii Lasch.
On *Cirsium Flodmannii.* Kulm, Aug., 1909.
(Fungi Dak. *64.*)

Puccinia Convolvuli Cast.
On *Calystegia sepium.* Fargo, Valley City, 1884, Seymour.

Puccinia Coronata Corda.
On *Avena sativa, Calamagrostis hyperborea,* and *Scolochloa festucacea.* Kulm, Oct., 1911, also 1884, Seymour.
(Fungi Dak. *340, 340a, 414, 113.*)

Puccinia Crandellii Pam. & Hume.
On *Festuca ovina, Symphoricarpos occidentalis.* Kulm, June, 1909.
(Fungi Dak. *81, 76 Aecidium abundans* Peck.)

Puccinia DeBaryana Thüm.
On *Pulsatilla hirsutissima.* Kulm, June, 1908.
(Fungi Dak. *61.*)

Puccinia distichlis Ellis & Everh.
On *Spartina Michauxiana,* and *S. gracilis.* Kulm.
On *Steironema ciliatum.* Kulm, Oct., 1908, and Fargo, May, 1915, Stevens.
(Fungi Dak. *108, 316.*)

Puccinia Eatoniae Arth.
On *Sphenopholis obtusata,* and *S. pallens.* Beaver Lake, July, 1909.
On *Ranunculus abortivus.* Fargo, May, 1915. Stevens.
(Fungi Dak. *184.*)

Puccinia Ellisiana Thüm.
On *Andropogon scoparius.* Kulm, Aug., 1909.
On *Viola papilionacea,* and *V. Lunellii.* Kulm, May, 1912.
(Fungi Dak. *40, 151 Aecidium Violae* Schum.)

Puccinia Epilobii DC.
On *Epilobium paniculatum.* Wild Rice, Aug., 1915, Stevens.

Puccinia extensicola Plowr.
On *Carex cephaloidea, C. festucacea, C. viridula, C. vulpinoidea* and other spp. of *Carex.* Kulm, Fargo, Washburn, Bismark, Stevens.
On *Aster multiflorus, A. paniculatus, Solidago canadensis, S. serotina,* and *S. missouriensis.* Kulm, Fargo.
(Fungi Dak. *341, 341a, 364, 364a, 103 Aecidium solidaginicolum.*)

Puccinia flosculosarum (Albert. & Schw.) Roehl.
On *Cnicus.* Fargo, 1884, Seymour.

Puccinia fraxinata (Schw.) Arth.
Spartina Michauxiana, S. gracilis, and *Fraxinus lanceolata.* Kulm, Sept., 1909, and June, 1908.
(Fungi Dak. *15, 2 Aecidium Fraxini* Schw.)

Puccinia Gentiani (Str.) Link.
On *Gentiana affinis.* Leeds, Sept., 1916, Lunell.
On *Gentiana puberula.* Kulm, Sept., 1913, also 1884, Seymour.
(Fungi Dak. *415.*)

Puccinia gigantispora Bubak.
On *Anemone cylindrica.* Kulm, July, 1908.

Puccinia graminis Pers.
On *Agropyron pseudorepens, A. tenerum, A. occidentalis, A. Richardsonii, Avena fatua, A. sativa, Beckmannia erucaeformis, Elymus canadensis, Hordeum jubatum, H. vulgare, Koeleria cristata, Triticum sativum,* and *T. Spelt.* Kulm, Aug., 1910.
(Fungi Dak. *13, 43, 44, 44a, 44b, 44c.*)

Puccinia Grindeliae Peck.
On *Gutierrezia Sarothrae.* Beaver Lake, July, 1908.

Puccinia Grossulariae (Schum.) Lagerh.
On *Carex laxiflora.* Fargo, Sept., 1915, Stevens.
On *Ribes floridum, R. americanum,* and *R. Uva-crispa.* Kulm, Leeds, and Lunell.
(Fungi Dak. *365, 201* as *Aecidium Grossulariae* DC.)

Puccinia Helianthi Schw.
On *Helianthus annuus, H. Maximiliani, H. nitidus, H. subrhomboideus, H. tuberosus.* Kulm, Fargo, Leeds, Beaver Lake, also 1884, Seymour.
(Fungi Dak. *45, 45a, 153, 153a, 366.*)

Puccinia hemisphaerica (Peck) Ellis & Everh.
On *Lactuca pulchella.* Kulm, July, 1909.
(Fungi Dak. *62, 62a.*)

Puccinia Heucherae (Schw.) Diet.
On *Heuchera hispida.* Kulm, June, 1909.
(Fungi Dak. *63.*)

Puccinia Hieracii (Schw.) Mart.
On *Hieracium umbellatum.* Turtle Mts., Aug., 1907, Lunell.

Puccinia Impatientis (Schw.) Arth.
On *Impatiens biflora.* Fargo, July, 1915, Stevens.

Puccinia Koeleriae Arth.
On *Koeleria cristata.* Kulm, Aug., 1909.
(Fungi Dak. *82.*)

Puccinia Kuhniae Schw.
On *Kuhnia eupatorioides.* Bismark, Valley City, 1884, Seymour.

Puccinia ludibunda Ellis & Everh.
On *Carex Bebbii.* Beaver Lake, Aug., 1912.
(Fungi Dak. *186.*)

Puccinia Menthae Pers. var. *americana* Peck.
On *Mentha canadensis,* and *Monarda fistulosa.* Kulm, Mandan, Bismark, also 1884, Seymour.
(Fungi Dak. *14, 342.*)

Puccinia montanensis Ellis.
On *Agropyron tenerum, A. occidentale, Elymus canadensis, Onosmodium molle, Lithospermum angustifolium,* and *Thalictrum dasycarpum.* Kulm, Fargo, Leeds.
(Fungi Dak. *343, 104, Aecidium Thalictri, 343, 367, 367a.*)

Puccinia Muhlenbergiae Arth. & Holw.
On *Muhlenbergia racemosa.* Kulm, March, 1910.
(Fungi Dak. *110.*)

Puccinia Opizii Bubak.
On *Carex camporum, C. saccata, Lactuca pulchella, L. Scariola,* and *Nabalus racemosus.* Kulm, June, 1909, Aug., 1909, Leeds, Oct., 1916, Lunell.
(Fungi Dak. *111, 111a, 417.*)

Puccinia ornata Arth. & Holw.
On *Rumex occidentalis.* Towner, July, 1913, Lunell.

Puccinia Peckii Arth.
On *Carex Hookeriana.* Pleasant Lake, July, 1912, Lunell.
On *Carex lanuginosa, Oenothera strigosa,* and *Meriolix serrulata.* Kulm, June, and Aug., 1909.
(Fungi Dak. *65, 65a, 112.*)

Puccinia Poarum Neils.
On *Poa pratensis.* Fargo, Oct., 1914, Stevens.
(Fungi Dak. *291.*)

Puccinia Pruni-spinosae Pers.
On *Prunus americana*. Valley City, 1884, Seymour.
Puccinia pustulata Arth.
On *Andropogon furcatus, A. Hallii,* and *Comandra pallida*. Kulm, June, 1909.
(Fungi Dak. *83, 83a, 368.*)
Puccinia quadriporula Arth.
On *Carex Heydeni*. Kulm, July, 1908.
(Fungi Dak. *243.*)
Puccinia Rubella (Pers.) Arth.
On *Phragmites communis*. Leeds, Sept., 1912, Lunell.
On *Rumex salicifolia*. Fargo, June, 1915.
(Fungi Dak. *187.*)
Puccinia rubefaciens Johans.
On *Galium boreale*. Kulm, Aug., 1908.
On *G. linearifolium*. Leeds, Lunell, also 1884, Seymour.
(Fungi Dak. *16, 244.*)
Puccinia Rubigo-vera (DC.) Wint.
On *Hordeum jubatum*. Kulm, Oct., 1909.
(Fungi Dak. *154.*)
Puccinia Seymouriana Arth.
On *Asclepias speciosa*. Bismark, Aug. 22, 1915.
Puccinia similima Arth.
On *Anemone canadensis*. Kulm, June, 1909.
On *Phragmitis communis*. Kulm, Nov., 1914.
(Fungi Dak. *115, 292.*)
Puccinia Sherardiana Koern.
On *Malvastrum coccineum*. Kulm, June, 1910.
(Fungi Dak. *66.*)
Puccinia Silphii Schw.
On *Silphium perfoliatum*. Fargo, July, 1914, Stevens and Seaver.
(Fungi Dak. *262.*)
Puccinia Sorghi Schw.
On *Zea Mays*. Kulm, Sept., 1908.
On *Oxalis stricta*. Kulm.
(Fungi Dak. *114, 114a.*)
Puccinia Sporoboli Arth.
On *Sporobolus heterolepis*. Kulm, Aug., 1915.
(Fungi Dak. *344.*)
Puccinia Stipae Arth.
On *Stipa spartea, Solidago missouriensis,* and *S. mollis*. Kulm, June and Aug., 1910, also 1884, Seymour.
(Fungi Dak. *67, 188.*)
Puccinia subnitens Diet.
On *Distichlis maritima,* and *Atriplex hastata*. Kulm, Aug., 1908.
(Fungi Dak. *47, 130.*)
Puccinia substerilis Ellis & Everh.
On *Stipa viridula*. Kulm, Jan., 1908.
(Fungi Dak. *84.*)

Puccinia Tanaceti DC.
On *Artemisia cana, A. frigida, A. longifolia,* and *A. ludoviciana.* Kulm, Sentinal Butte, and Leeds, also 1884, Seymour.
(Fungi Dak. *318, 418.*)

Puccinia Taraxaci (Recent.) Plowr.
On *Taraxacum officinale.* Kulm, Aug., 1908.
(Fungi Dak. *69.*)

Puccinia tosta Arth.
On *Sporobolus cuspidatus,* and *S. asperifolius.* Kulm, Oct., 1909.
(Fungi Dak. *46, 116.*)

Puccinia tomipara Trelease.
On *Bromus purgans.* Voltaire, Fred Schmidt, Jr.

Puccinia triticina Ericks.
On *Triticum vulgare.* Kulm, Aug., 1914.
(Fungi Dak. *345.*)

Puccinia universalis Arth.
On *Carex pennsylvanica, C. stenophylla,* and *C.* sp. Kulm, June, 1908.
On *Artemisia biennis, A. frigida, A. longifolia,* and *A. ludoviciana.* Kulm.
On *Hieracium umbellatum.* Fargo, June, 1915, Stevens.
(Fungi Dak. *106, 242, 189, 117, 131, 346.*)

Puccinia Urticae (Schw.) Lagerh.
On *Carex stricta, C. atherodes,* and *Urtica gracilis.* Kulm and Fargo.
(Fungi Dak. *12, 118, 294.*)

Puccinia Vernoniae Schw.
On *Vernonia fasciculata.* Kulm, Aug., 1915.
(Fungi Dak. *369.*)

Puccinia vexans Farl.
On *Atheropogon curtipendulus.* Kulm, March, 1908.
(Fungi Dak. *17.*)

Puccinia Violae (Schum.) DC.
On *Viola canadensis, V. papilionacea, V. arenaria.* Kulm, Sept., 1909.
(Fungi Dak. *245, 370, 419.*)

Puccinia Vulpinoidis Arth.
On *Carex vulpinoidea.* Kulm, Aug., 1908.

Puccinia Xanthii Schw.
On *Xanthium canadense.* Medora, 1884, Seymour.

Pucciniastrum Agrimoniae (Schw.) Tranz.
On *Agrimonia hirsuta.* Kulm, Aug., 1909.
(Fungi Dak. *85.*)

Pucciniastrum arcticum-americanum Farl.
On *Rubus strigosus.* Fargo, Oct., 1914.
(Fungi Dak. *293.*)

Pucciniastrum pustulatum (Pers.) Diet.
On *Chamaenerion angustifolium.* Sentinel Butte, Aug., 1916.
On *Epilobium adenocaulon.* Minot, Aug., 1915, Stevens.
(Fungi Dak. *371, 420.*)

Schizonella melanogramma (DC.) Schröt.
On *Carex pennsylvanica.* Kulm, July, 1913.
(Fungi Dak. *246.*)

Sphacelotheca montaniensis (Ellis & Everh.) Clint.
On *Muhlenbergia glomerata*. Beaver Lake, July, 1909. (Fungi Dak. *190*.)

Sphacelotheca occidentalis (Seym.) Clint.
On *Andropogon Hallii*. Anselm, Aug., 1916. (Fungi Dak. *421*.)

Sorosporium Ellisii Wint. var. *occidentalis* Seymour.
On *Andropogon furcatus*. Bismark, Sept., 1884, Seymour.

Sorosporium Syntherismae (Peck) Farl.
On *Cenchrus tribuloides*. Powers' ranch, Aug., 1916, Stevens.

Tilletia Earlei Griff.
On *Agropyron repens*. Leeds, Oct., 1916, Lunell.

Tilletia Tritici (Bjerk.) Wint.
On *Triticum vulgare* and *T. Spelta*. Kulm, Aug., 1909. (Fungi Dak. *132*, *132a*.)

Urocystis Anemones (Pers.) Schroet.
On *Pulsatilla hirsutissima*. Kulm, June, 1908. (Fungi Dak. *18*.)

Uromyces astragalicola P. Henn.
On *Astragalus adsurgens*. Sentinel Butte, Aug., 1916. (Fungi Dak. *425*.)

Uromyces dictyosperma Ellis & Everh.
On *Tithymalus missouriensis*. Fargo, July, 1914.

Uromyces Glycyrrhizae (Rabh.) Magnus.
On *Glycyrrhiza lepidota*. Kulm, June, 1908. (Fungi Dak. *19*.)

Uromyces Rudbeckiae Arth. & Holw.
On *Rudbeckia laciniata*. Fargo, July, 1914. (Fungi Dak. *274*.)

Uromycopsis porosa (Peck) Arth.
On *Vicia americana*, *V. linearis*, and *Psoralea argophylla*. Kulm, June, and Aug., 1909.
(Fungi Dak. *73*, *Uromyces Psoraleae* (Pers.) Fuckel, *191*, *191a*, *205*, *3*.)

Uropyxis Amorphae Schroet.
On *Amorpha canescens*, *A. fruticosa*, and *A. nana*. Kulm, and Beaver Lake, also 1884, Seymour.
(Fungi Dak. *88*, *192*, *192a*, *248*.)

Uropyxis Petalostemonis Farl.
On *Kuhnistera candida*. Kulm, June, 1909, also 1884, Seymour. (Fungi Dak. *89*.)

Ustilago Avena var. *levis* Kellerm. & Swing.
On *Avena sativa*. Kulm, July, 1908. (Fungi Dak. *90*.)

Ustilago foetens (Berk. & Curt.) Tul.
On *Triticum vulgare*. Kulm, Sept., 1908.

Ustilago Hieronymi Schroet.
On *Atheropogon curtipendulus*. Beaver Lake, July, 1909. (Fungi Dak. *75*.)

Ustilago Hordei (Pers.) Kellerm. & Swing.
On *Hordeum vulgare*. Kulm, Aug., 1908.
(Fungi Dak. *23*.)
Ustilago hypodytes (Schl.) Fr.
On *Stipa spartea*. Beaver Lake, July, 1909.
Ustilago levis (Kellerm. & Swing.) Magn.
On *Avena sativa*. Kulm, July, 1909.
(Fungi Dak. —.)
Ustilago Lorentziana Thüm.
On *Hordeum jubatum*. Kulm, July, 1908.
(Fungi Dak. *24*.)
Ustilago longissima (Sow.) Tul.
On *Panicularia americana*. Kulm, Aug., 1909.
(Fungi Dak. *135*.)
Ustilago Maydis (DC.) Corda.
On *Zea Mays*. Kulm, Aug., 1908.
(Fungi Dak. *156*.)
Ustilago neglecta Niessl.
On *Chaetochloa glauca*. Fargo, 1907, Seaver.
(Fungi Dak. *275*.)
Ustilago nuda Kellerm. & Swing.
On *Hordem vulgare*. Kulm, July, 1908.
(Fungi Dak. *25*.)
Ustilago Panici-miliacei (Pers.) Wint.
On *Panicum miliaceum*. Kulm, Aug., 1909.
(Fungi Dak. *91*.)
Ustilago Tritici (Pers.) Jens.
On *Triticum vulgare*. Kulm, July, 1907.
(Fungi Dak. *167*.)
Ustilago subinclusa Körn.
On *Carex trichocarpa* var. *Deweyi*. Bismark, Sept., 1884, Seymour.

IV. HIGHER BASIDIOMYCETES

Agaricus campestris Linn.
On pastures and prairies. July, 1910.
Agaricus campestris L. var. *praticola*. (A large fleshy variety.)
On manure. Kulm, June, 1910.
Bovista pila Berk.
In pasture under trees. Kulm, June, 1913.
(Fungi Dak. *304*.)
Bovista plumbea Pers.
Barnyards and pastures. Kulm, fall, 1909.
(Fungi Dak. *92*.)
Bovistella echinella Pat.
On moss sod. Anselm, Aug., 1916.
(Fungi Dak. *376*.)
Bovistella dealbata (Sacc.) Lloyd.
On lawn. Kulm, July, 1908.

Calvatia caelata Bull.
On open prairie. Dickenson, L. R. Waldron, also Kulm. (Fungi Dak. *171*.)
Calvatia lilacina var. *occidentalis* Lloyd.
On open prairie. Kulm, July, 1908. (Fungi Dak. *172*.)
Catastoma circumscissum Berk. & Curt.
On pastures. Kulm, Sept., 1908. (Fungi Dak. *29*.)
Catastoma nigrescens Lloyd.
On old manured ground. Kulm, fall, 1908. (Fungi Dak. *207*.)
Catastoma subterraneum Lloyd.
Waste places. Dickenson, L. R. Waldron.
Clitocybe dealbata Sow.
On pastures. Kulm, Aug., 1911.
Clitocybe infundibuliformis Schaeff.
Soil in woods. Anselm, Aug., 1916.
Coprinus atramentarius (Bull.) Fr.
Around cotton-wood stumps. Kulm, July, 1914.
Coprinus comatus Fr.
On newly turned soil. Kulm, Oct., 1911.
Coprinus ephemerus Fr.
On fresh manure. Kulm, May, 1908.
Coprinus micaceus Fr.
Waste places on soil. Kulm, May, 1908.
Coprinus fimetaris Fr.
On new manure. Kulm, May, 1910.
Cortinarius ochroleucus Fr.
On soil under trees. Kulm, July, 1914.
Corticium byssinum (Karst.) Burt.
On *Symphoricarpos occidentalis*. Kulm, July, 1916.
Corticium cremicolor Berk. & Curt.
On *Corylus americana*. Fargo, Nov., 1916, Stevens.
Corticium laetum Karst.
On *Symphoricarpos occidentalis*. Kulm, Nov., 1916.
Corticium vellereum Ellis & Cragin.
On *Populus tremuloides*. Camp Crook, S. Dak., July, 1912, Weir.
Crucibulum vulgare Tul.
On leaves and twigs, in woods. Anselm, Aug., 1916.
Cyathus Schweinitzii Tul.
On twigs. Kulm, Apr., 1908. Fargo, woods, July, 1914. Valley City, June, 1906, Perrine.
Cyathus stercoreus Schw.
On manure and soil. Kulm, Sept., 1908.
Cyathus vernicosus DC.
Valley City, June, 1906, Perrine.

Daedalea confragosa (Bolt.) Pers.
On *Salix*. Kulm, Fargo, and Ft. Ransom.
(Fungi Dak. *356*.)
Daedalea unicolor Bull.
On wood. Fargo, July, 1914.
Fomes applanatus Pers.
On *Populus deltoides*. Kulm and Ft. Ransom, 1916. Camp Crook, S. D., Weir.
Fomes conchatus Pers.
On *Salix longifolia*. Kulm, Oct., 1916.
Fomes Ellisianus Anders.
On *Shepherdia argentea*. Camp Crook, S. D., 1912, Weir, Dickenson, Sept. 1, 1916.
(Fungi Dak. *380*.)
Fomes fomentarius Gill.
On birch cordwood (shipped in). Kulm, 1909.
Fomes fraxinophilus Peck.
On *Fraxinus lanceolata*, and (*Quercus macrocarpa ?*). Fargo, 1914, and Ft. Ransom, 1916. Camp Crook, S. D., 1912, Weir.
(Fungi Dak. *381*.)
Fomes igniarius (L.) Gill.
On *Ostrya virginiana* and *Populus tremuloides*. Fargo, 1914, 1916, Stevens. Camp Crook, S. Dak., 1912, Weir.
Fomes Laricis Rubel.
On *Pinus ponderosa*. Camp Crook, S. D., 1912, Weir.
Fomes ohiensis Berk.
On *Quercus macrocarpa*. Fargo woods, June, 1914.
Fomes Pini (Brot.) Lloyd.
On *Pinus ponderosa*. Camp Crook, S. D., 1912, Weir.
Fomes pinicola Swartz.
On *Pinus ponderosa*. Camp Crook, S. D., 1912, Weir.
Fomes pomaceus Pers.
On *Prunus americana* and *P. melanocarpa*. Fargo, Ft. Ransom and Sentinal Butte, N. D., also Camp Crook, S. D., Weir.
(Fungi Dak. *382*.)
Fomes Ribis (Schum.) Gill.
On *Symphoricarpos occidentalis* in the fall. Kulm and Bismark, 1910.
(Fungi Dak. *404*.)
Fomes scutellatus Schw.
On *Acer negundo*. Ft. Ransom, Aug., 1916.
Galera crispa Longyear.
On lawns. Kulm, July, 1914.
Galera lateritia Fr.
On lawns. Kulm, Aug., 1915.
Galera tener (Schaeff.) Quél.
On lawns. Kulm, July, 1912.
Geaster asper Michel.
Waste places on soil. Kulm, 1908. Leeds, 1910, Lunell.
(Fungi Dak. *35*.)

Geaster floriformis Vitt.
On prairie. Kulm, 1906.
(Fungi Dak. *36*.)
Geaster mammosus Chev.
On soil in woods. Fargo, 1905, L. R. Waldron.
(Fungi Dak. *254*.)
Geaster saccatus Fr.
On soil in woods. Anselm, Aug., 1916.
Hebeloma glutinosum Linn.
On old straw. Kulm, Sept., 1911.
Hymenochaete cinnamomea Pers.
On *Corylus americana.* Fargo, Nov., 1916, Stevens.
Hymenochaete Curtisii Berk.
On *Quercus marcrocarpa.* Ft. Ransom, Aug., 1916.
Hymenochaete tabacina (Sow.) Lev.
On *Amelanchier alnifolia.* Camp Crook, S. D., July, 1912, Weir.
Irpex lacteus Fr.
On *Fraxinus lanceolata, Populus deltoides, Prunus americana, Symphoricarpos occidentalis,* and *Vitis vulpinus.* Kulm, Fargo, and Ft. Ransom.
(Fungi Dak. *122*.)
Lentinus squamosus Schaef.
On R. R. ties. Kulm, May, 1910.
Lenzites betulina (L.) Fr.
On birch. Walhalla, Waldron.
Lenzites saepiaria Fr.
On R. R. ties. Kulm.
On *Pinus ponderosa.* Camp Crook, S. D., Weir.
(Fungi Dak. *405*.)
Lenzites vialis Peck.
On pine board. Kulm, July, 1914.
Lepiota granulosa Batsch.
On wood, under trees. Kulm, July, 1914.
Lepiota naucina Fr.
On lawn. Kulm, Sept., 1911, and Dacotah, Brenckle.
Lepiota procera Scop.
In meadow. Kulm, June, 1908.
Lycoperdon cepaeforme Morg.
On prairie. Kulm, and Dickenson, 1906, Waldron.
(Fungi Dak. *93*.)
Lycoperdon cruciatum Roth.
On prairie. Dickenson, 1906, Waldron.
Lycoperdon dakotensis Brenckle & Lloyd.
On prairie. Kulm, 1908.
(Fungi Dak. *94*.)
Lycoperdon gemmatum Batsch.
On soil in woods. Ft. Ransom, Aug., 1916, Stevens.
Lycoperdon rimulatum Peck.
On sand hills. Anselm, Aug., 1916.

Lycoperdon umbrinum Pers.
On decaying wood. Ft. Ransom, Aug., 1916, Stevens.
Lycoperdon Wrightii Berk. & Curt.
On prairie. Kulm, June, 1907.
(Fungi Dak. *95*.)
Marasmius caricicola Kauffm.
On *Carex* culms and leaves. Kulm, Sept., 1914.
Marasmius oreades Fr.
In meadow. Kulm, July, 1912.
Marasmius rotula Fr.
On old *Acer negundo*. Kulm, Aug., 1911.
(Fungi Dak. *173*.)
Marasmius siccus Schw.
On twigs and wood. Anselm, Aug., 1916.
Mycenastrum corium Desv.
On old manure. Kulm, Aug., 1908. Fargo, Stevens.
(Fungi Dak. *170*.)
Naucoria pediades Fr.
In meadow. Kulm, June, 1914.
Omphalia pyxidata Bull.
On moss sod. Kulm, Aug., 1911.
Panaeolus solidipes Peck.
On manure. Kulm, June, 1909.
Panaeolus fimicola Fr.
On cow dung. Kulm, Aug., 1911.
Panaeolus retirugis Fr.
On old straw. Kulm, July, 1911.
Peniphora Allescheri Bres.
On *Populus angustifolia*. Camp Crook, S. D., Weir.
Peniphora cinerea Cooke.
On *Symphoricarpos occidentalis*. Kulm, Nov., 1916.
Peniphora crassa Burt.
On *Pinus ponderosa*. Camp Crook, S. D., 1912, Weir.
Phlebia reflexa Berk.
On *Populus tremuloides*. Anselm, Aug., 1916.
Pholiota adiposa Fr.
On lawn. Kulm, Aug., 1914.
Pholiota praecox Pers.
On prairie. Kulm, May, 1908.
Pholiota praecox Pers. var. *minor* Batt.
On low meadow. Kulm, May, 1910.
Pleurotus ostreatus Jacq.
On *Populus deltoides*. Kulm, Aug., 1911.
Polyporus adustus Willd.
On *Acer Negundo*, and *Populus deltoides*. Kulm, 1911.
On *Populus angustifolia*. Camp Crook, S. D., 1912, Weir.
Polyporus amorphus Fr.
On *Pinus ponderosa*. Camp Crook, S. D., Weir.

Polyporus cryptopus Ellis.
On prairie. Kulm, July, 1909.
(Fungi Dak. *148*.)
Polyporus dichrous Fr.
On *Fraxinus lanceolata*. Ft. Ransom, Aug., 1916.
On *Populus tremuloides*. Camp Crook, S. D., July, 1912, Weir.
Polyporus elegans Bull.
On fallen branches. Mandan, Aug., 1915.
Polyporus gilvus (Schw.) Fr.
On *Quercus macrocarpa*, and *Prunus americana*. Fargo, Nov., 1915. Stevens.
(Fungi Dak. *411*.)
Polyporus spumeus Sow.
On *Populus angustifolia*. Camp Crook, S. D., 1912, Weir.
Polystictus conchifer Schw.
On log (*Ostrya virginica ?*). Power's ranch, Aug., 1916.
Polystictus hirsutus Wolf.
On *Quercus macrocarpa*, and *Prunus americana*. Kulm, Delaney's Ranch.
Polystictus pargamenus Fr.
On *Populus tremuloides*. Fargo, Ft. Ransom, Aug., 1916, Waldron, Stevens.
(Fungi Dak. *412*.)
Polystictus planus Peck.
On fallen twigs. Anselm, Aug., 1916.
Polystictus versicolor Fr.
On *Prunus americana* and *Quercus macrocarpa*. Kulm and Fargo, Waldron.
(Fungi Dak. *413*, *413a*.)
Poria laminata Murr.
On *Prunus americana*. Fargo, Nov., 1916, Stevens.
Poria punctata Fr.
On *Tilia americana*. Anselm, Aug., 1916.
Russula emetica Fr.
On soil in woods. Anselm, Aug., 1916.
Schizophyllum commune Fr.
On *Acer Negundo*. Kulm, Nov., 1911 and Fargo, 1906, Waldron.
Secotium acuminatum Mont.
Waste places. Kulm, Aug., 1908 and Dickenson, Waldron.
(Fungi Dak. *49*.)
Stereum fasciatum Schw.
On *Populus tremuloides*. Camp Crook, S. D., 1912, Weir.
(Fungi Dak. *422*.)
Stereum frustulatum Fr.
On *Quercus macrocarpa*. Fargo, June, 1914.
Stereum purpureum Pers.
On *Acer Negundo*. Kulm, Camp Crook, S. D., Weir.
(Fungi Dak. *175*.)
Stereum rufum Fr.
On *Populus tremuloides*. Fargo, July, 1914.
(Fungi Dak. *279*, as *Hypocrea Richardsoni* Berk. & Mont.)

Stereum versicolor Fr.
Woods. Fargo, 1906, Waldron.
Thelephora cuticularis Berk.
On wood. Anselm, Aug., 1916.
Thelephora terrestris Ehrh.
On pine needles. Camp Crook, S. D., Weir.
(Fungi Dak. *423*.)
Trametes carnea Nees.
On *Pinus ponderosa*. Camp Crook, S. D., 1912, Weir.
Trametes hispida Bagl.
On *Populus deltoides*. Kulm, June, 1913.
On *Populus angustifolia*. Camp Crook, S. D., Weir.
Trametes setosus Weir.
On *Pinus ponderosa*. Camp Crook, S. D., June, 1912, Weir.
Trametes suaveolens Linn.
On *Populus tremuloides*. Camp Crook, S. D., 1912, Weir.
Tricholoma paedidum Fr.
In pasture. Kulm, July, 1914.
Tricholoma melaleucum Pers.
On soil under trees. Kulm, July, 1914.
Tricholoma equestre L. ?
On prairie. Kulm, Aug., 1910.
Tylostoma americanum.
Waste places. Dickenson, 1906, Waldron.
Tylostoma mammosum (Mich.) Fr.
Manure. Kulm, July, 1907.

V. FUNGI IMPERFECTI

Actinonema Rosae (Lib.) Fr.
On *Rosa heliophylla*. Fargo, Stevens.
Alternaria tenuis Nees.
On leaves of *Populus deltoides*. Kulm, Aug., 1914.
Botrytis vulgaris Link, var. *interrupta* Trans.
On galls of *Populus deltoides*. Kulm, Aug., 1913.
Cercospora Absinthii Sacc.
On *Artemisia Absinthium*. Kulm, Aug. 24, 1916.
(Fungi Dak. *402*.)
Cercospora Alismatis Ellis & Holw.
On *Alisma Plantago-aquatica*. Kulm, July, 1908.
Cercospora avicularis Wint.
On *Polygonum aviculare*. Kulm, July, 1908.
Cercospora Chenopodii Fres.
On *Chenopodium album*, and *C. rubrum*. Aug., 1908.
(Fungi Dak. *32*, *194*.)
Cercospora circumscissa Sacc.
On *Prunus melanocarpa* and *P. americana*. Kulm, June, 1908.
(Fungi Dak. *31*.)
Cercospora elaeochroma Sacc. n. sp.
On *Asclepias speciosa*. Bismark, Aug., 1915.
(Fungi Dak. *354*.)

Cercospora dubia Fr.
On *Atriplex hastata*. Kulm, Aug., 1908.
Cercospora melanochaeta Ellis & Everh.
On *Celastrus scandens*. Delaney's Ranch, Aug., 1915.
Cercospora Pentstemonis Ellis & Kellerm.
On *Pentstemon grandiflorus*. Anselm, Aug., 1916, Stevens.
Cercospora Violae Sacc.
On *Viola papilionacea*. Kulm, July, 1913.
(Fungi Dak. *228*.)
Cercosporella Anethi Sacc. n. sp.
On *Anethum graveolens*. Kulm, Oct., 1914.
(Fungi Dak. *353*.)
Cicinnobolus Casatii DeBary.
On conidia. Kulm, July, 1912.
(Fungi Dak. *196*.)
Cladosporium graminum Corda, f. *caricicola* Sacc.
On *Carex festucacea*. Kulm, Aug., 1913.
Cladosporium Typharum Desm.
On *Typha latifolia*. Kulm, July, 1913.
Coniothecium Mollerianum Thüm.
On stems of *Aster multiflorus*. Kulm, July, 1913.
Colletotrichum Lindemuthianum (Sacc.) Bri. & Cav.
On *Phaseolus nanus*. Kulm, Aug., 1908.
Colletotrichum lineota Corda.
On *Andropogon furcatus*. Kulm, May, 1915.
Coryneum salicinum (Corda) Sacc.
On *Salix longifolia*. Kulm, Feb., 1913.
(Fungi Dak. *210*.)
Cylindrosporium Heraclei Ellis & Everh.
On *Heracleum lanatum*. Wirch Lake, June, 1910.
Cylindrosporium Toxicodendri (Curt.) Ellis & Everh.
On *Rhus radicans*. Kulm and Leeds, July, 1914, Lunell.
(Fungi Dak. *273*.)
Darluca filum (Bivon.) Cast.
On various uredinia. Kulm and Fargo, Stevens.
Didymaria Astragali Ellis & Holw.
On *Astragalus carolinianus*. Kulm, Aug., 1914.
Dinemasporium graminum (Lib.) Lev. var. *strigosulum* Karst.
On old *Agropyron tenerum*. Kulm, July, 1913.
Dinemasporium hispidulum (Schrad.) Sacc.
On *Acer Negundo*. Kulm, Oct., 1914.
Ellisiella caudata Sacc.
On *Andropogon furcatus*. Kulm, July, 1914.
Epicoccum neglectum Desm.
On *Lotus americanus*. Kulm, June, 1915.
Fusarium cinnabarium Sacc.
On *Acer Negundo*. Kulm, Aug., 1910.
Fusarium Lini Bolley.
On *Linum usitatissimum*. Kulm, Aug., 1909.
(Fungi Dak. *55*.)

Fusicladium dentriticum Fuckel.

On apple and crab-apple leaves. Kulm and Garrison, Aug., 1915, Stevens. (Fungi Dak. *229*.)

Fusicoccum dakotense Sacc. & Syd. n. sp.

On *Prunus melanocarpa*. Kulm, May, 1913.

Gloeosporium septorioides Sacc.

On *Quercus macrocarpa*. Fargo, July, 1914.

Helminthosporium avenaceum Curt.

On *Avena sativa*. Kulm, Aug., 1914.

Helminthosporium Urtici = *H. Urticum* Peck.

On dead stems of *Urtica gracilis*. Kulm, Oct., 1916.

Forming dark brown, velutine spots, widely effused to completely covering sections of the stems.

Hyphae brown, erect, at first short, one or two septate, later proliferous, elongated and branched with many septa, to 300 μ long. Cells of the hyphae are often bulbous at the apex, 15 to 40 μ long, 3 to 6 μ in diameter, 6 to 8 μ at the bulbous apex. Cells are sometimes offset at the joints.

Conidia are abundant, cylindrical, rounded at ends, brown, 3-septate, minutely and obscurely warted, 16 to 30 $\times$ 6 to 9 μ.

Hendersonia arundinacea (Desm.) Sacc.

On *Phragmites communis*. Kulm, Nov., 1914.

Hendersonia Crataegi n. sp.

On leaves of *Crataegus mollis*. Fargo, Sept. and Oct., 1916, Stevens.

Causes irregular brown areas of various sizes outlined by the capillary veins.

Mature acervuli few, usually epiphyllus, on pallid spots, black, flattish, minute to 1/5 mm. in diameter, irregular in outline.

Sporules ovate-oblong, straight or somewhat curved, sooty tinted or black, 3-septate, rounded at the apex while the proximal cell is subacute and hyaline, with a pedicel sometimes attached, 14–22 $\times$ 5–7 μ. Pedicels hyaline up to 25 μ long.

Heterosporium tuberculans Ellis & Everh.

On *Iva xanthiifolia*. Kulm, Oct., 1908.

(Fungi Dak. *255*.)

Kellermania Sisyrinchii Ellis & Everh.

On *Sisyrinchium angustifolium*. Kulm, June, 1916.

(Fungi Dak. *383*.)

Leptotherium gentianaecolum (DC.) Beauml.

On *Gentiana Andrewsii*. Anselm, Aug., 1916.

(Fungi Dak. *385*.)

Macrophoma Brenckleana Sacc. & Syd. n. sp.

On *Salix longifolia*. Kulm, Feb., 1913.

Macrophoma smilacina (Peck) Bert. & Vogl.

On *Smilax herbacea*. Mandan, Aug., 1915.

Macrosporium fasciculatum Cooke & Ellis.

On *Phaseolus nanus*. Kulm, Aug., 1908.

(Fungi Dak. *56*.)

Macrosporium heteronemum Desm.

On *Robinia hispida* (in cult.). Kulm, Sept., 1914.

(Fungi Dak. *368*.)

Macrosporium parasiticum Thüm.
On *Ramularia Armoraciae* Fuckel. Kulm, Aug., 1914.
(Fungi Dak. *258*.)
Macrosporium tomato Cooke.
On garden tomato. Kulm, Aug., 1908.
Melanoconium cerasium Peck.
On *Prunus melanocarpa*. Kulm, May, 1913.
(Fungi Dak. *387*.)
Monilia angustior Reade.
On *Prunus melanocarpa*. Kulm, June, 1913.
(Fungi Dak. *335*.)
Nematogonum aurantiacum Desm.
On bark of apple tree. Kulm, May, 1914.
Ovularia lotophaga Ellis & Everh.
On *Lotus americanus*. Kulm, Aug., 1912.
(Fungi Dak. *195*.)
Ovularia obliqua (Cooke) Oud.
On *Rumex crispa*. Kulm, Aug., 1915.
Phoma leptospora Sacc. n. sp.
On *Grindelia squarrosa*. Kulm, July, 1913.
Phoma Astragali Cooke & Hark.
On *Astragalus goniatus*. Kulm, July, 1908.
(Fungi Dak. *145*.)
Phyllosticta Betae Oudem.
On *Beta vulgaris*. Kulm, July, 1915.
(Fungi Dak. *362*.)
Phyllosticta crataegicola Sacc.
On *Crataegus mollis*. Kulm, Aug., 1914.
Phyllosticta cruenta Kickx.
On *Smilacina stellata*. Kulm, July, 1908.
(Fungi Dak. *287*.)
Phyllosticta destruens Desm.
On *Prunus melanocarpa*. Kulm, Sept., 1914.
Phyllosticta ivaecola Ellis & Everh.
Iva xanthiifolia. Kulm, July, 1914.
(Fungi Dak. *338*.)
Phyllosticta Labrusca Thüm.
On *Ampelopsis quinquefolia*. Kulm, Aug., 1916.
(Fungi Dak. *393*.)
Phyllosticta viridis Ellis & Kellerm.
On *Fraxinus pennsylvanica*. Newell, S. D., Aug., 1912.
Phyllosticta viticola Thüm.
On *Vitis vulpina*. Ft. Ransom, Aug., 1916.
(Fungi Dak. *409*.)
Phyllosticta sp.
On *Sium cicutaefolium*. Kulm, July, 1912.
Placospaeria Galii Sacc.
On *Galium boreale*. Kulm, Sept., 1914.
(Fungi Dak. *363*.)

Polythrincium Trifolii Kuntze.
On *Trifolium repens.* Kulm, Sept., 1909.
On *Trifolium Michelianum.* Fargo, Aug., 1916, Stevens.
(Fungi Dak. *57.*)
Ramularia Armoraciae Fuckel.
On *Roripa Armoracia.* Kulm, Aug., 1914.
(Fungi Dak. *263.*)
Ramularia arvensis Sacc.
On *Potentilla pentandra.* Kulm, June, 1913.
Ramularia Celastri Ellis.
On *Celastrus scandens.* Kulm, Aug., 1908.
Ramularia Heraclei (Oud.) Sacc.
On *Heracleum lanatum.* Kulm, July, 1908.
(Fungi Dak. *69.*)
Ramularia montana Speg.
On *Epilobium coloratum.* Kulm, Aug., 1915.
Ramularia rufo-maculans Peck.
On *Polygonum emersum.* Kulm, Sept., 1914.
Ramularia Taraxaci Karst.
On *Taraxacum officinale.* Fargo, Oct., 1914, Stevens.
(Fungi Dak. *295.*)
Ramularia Urticae Ces.
On *Urtica gracilis.* Kulm, Aug., 1912.
(Fungi Dak. *200.*)
Septoria Astragali Rab.
On *Lathyrus venosus.* Ft. Ransom, Aug., 1916.
Septoria Brencklei Sacc. n. sp.
On *Echinocystis lobata.* Kulm, July, 1913.
(Fungi Dak. *247, 247a.*)
Septoria bromigena Sacc. n. sp.
On *Bromus inermis.* Kulm, June, 1914.
(Fungi Dak. *319.*)
Septoria conspicua Ellis & Mart.
On *Steironema lanceolatum.* Fargo, Sept., 1914, Stevens.
Septoria Convolvuli Desm.
On *Convolvulus sepium.* Kulm and Fargo, Oct., 1914, Stevens.
(Fungi Dak. *265.*)
Septoria cornicola Desm.
On *Cornus stolonifera.* Ft. Ransom, Aug., 1916.
Septoria Crataegi Kickx.
On *Crataegus mollis.* Kulm, Oct., 1914, and Fargo, Sept., 1916, Stevens.
Septoria Fraxini Desm.
On *Fraxinus lanceolata.* Fargo, Sept., 1914, Stevens.
Septoria gaurina Ellis & Kellerm.
On *Gaura coccinea.* Kulm, June, 1909.
(Fungi Dak. *167.*)
Septoria Helianthi Ellis & Kellerm.
On *Helianthus annuus.* Kulm, July, 1914.
(Fungi Dak. *266.*)

Septoria irregularis Peck.
On *Pisum sativum*. Kulm, July, 1914.
Septoria Liatridis Ellis & Davis.
On *Liatris scariosa*. Kulm, June, 1914.
(Fungi Dak. *267*.)
Septoria littorea Sacc.
On *Apocynum cannabinum*. Kulm, July, 1916.
Septoria malvicola Ellis & Mart.
On *Malva rotundifolia*. Fargo, Sept., 1915, Stevens.
(Fungi Dak. *395*.)
Septoria Oenotherae Westd.
On *Anogra pallida* and *Onagra stigosa*. Kulm, June, 1914.
(Fungi Dak. *268*, *396*.)
Septoria peregrina Sacc. n. sp.
On *Conringia orientalis*. Kulm, July, 1915.
(Fungi Dak. *397*.)
Septoria Pisi West.
On *Pisum sativum*. Kulm, July, 1914.
(Fungi Dak. *269*.)
Septoria Polygonorum Desm.
Polygonum lapathifolium. Kulm, June, 1914.
(Fungi Dak. *270*.)
Septoria Pruni Ellis.
On *Prunus americana*. Fargo, Aug., 1915, Stevens.
Septoria psammophila Sacc. n. sp.
On *Astragalus pectinatus*. Lostwood, Aug., 1915, Stevens.
Septoria rhoina Sacc.
On *Rhus glabra*. Enderlin, Aug., 1916.
Septoria Ribis Desm.
On *Ribes rubrum*, *R. floridum*, and *R. Uva-crispa*. Kulm, July, 1914.
(Fungi Dak. *271*.)
Septoria Rudbeckiae Ellis & Hals.
On *Ratibida columnaris*. Kulm, July, 1915.
Septoria Rumicis Trail.
On *Rumex salicifolia*. Kulm and Fargo, June, 1915, Stevens.
Septoria Scrophulariae Peck.
On *Scrophularia leporella*. Ft. Ransom, Aug., 1916, Stevens.
(Fungi Dak. *398*.)
Septoria sibirica Thüm.
On *Ribes rubrum*. Kulm, July, 1914.
(Fungi Dak. *320*.)
Septoria Symphoricarpi Ellis & Everh.
On *Symphoricarpos occidentalis*. Kulm, Aug., 1914.
(Fungi Dak. *272*.)
Septoria Toxicodendri Curt.
On *Rhus radicans*. (See *Cylindrosporium Toxicodendri*.)
Septoria Xanthiifolia Ellis & Kellerm.
On *Iva xanthiifolia*. Kulm, July, 1914.
Septoria Ziziae Ellis & Everh.
On *Zizia cordata*. Kulm, July, 1914.

Sphaeropsis Clintonii Peck.
On *Acer Negundo*. Kulm, Apr., 1913.
(Fungi Dak. *218*.)

Sphaeropsis Peckii Sacc.
On *Prunus americana*. Fargo, July, 1914.

Sphaeropsis Rosarum Ellis & Everh.
On *Rosa blanda*. Kulm, May, 1914.

Sphaeropsis rubicola Cooke & Ellis.
On *Rubus strigosus*. Kulm, Apr., 1915.

Stagonospora Chenopodii Peck.
On *Chenopodium rubrum*. Kulm, Sept., 1914.

Stagonospora graminea Sacc.
On *Phragmites communis*. Kulm, Nov., 1914.

Stagonospora simplicior Sacc. & Briard.
On *Andropogon furcatus*. Kulm, July, 1914.

Stagonospora Smilacis (Ellis & Mort.) Sacc.
On *Smilax pulverulenta*. Fargo, Oct., 1916, Stevens.

Steirochaete Malvarum A. Br. & Casp.
On *Malva parviflora*. Kulm, July, 1912.
(Fungi Dak. *348*.)

Stemphylium botryosum Wats. var. *urocladium* Sacc.
On *Malvastrum coccineum*. Kulm, June, 1914.

Trimmatostroma Brencklei Sacc. n. sp.
On *Rosa heliophylla*. Kulm, June, 1914.

Trimmatostroma Salicis Corda.
On *Salix*. Kulm, June, 1912.

Tuberculina persicina Ditm.
On *Aecidiaceae*. Kulm and Leeds, July, 1913, Lunell.

Vermicularia dematium (Pers.) Fr.
On *Heracleum lanatum*. Beaver Lake, July, 1908.

Vermicularia dematium (Pers.) Fr. f. *minor* Sacc.
On *Taraxacum officinale*. Kulm, July, 1913.
(Fungi Dak. *400*.)

FORT DOUGLAS, UTAH.

NOTES AND BRIEF ARTICLES

Twenty-four new species and one new variety of *Inocybe* are described by Prof. G. F. Atkinson in the April number of the *American Journal of Botany*.

Dr. W. C. Coker, professor of botany in the State University of North Carolina, recently spent some time in the library of the New York Botanical Garden looking over mycological literature in connection with his work on the fungi of his state.

The *Bulletin* of the Torrey Botanical Club for April contains an article on "New Species of Uredineae" by Dr. J. C. Arthur, the paper being the tenth of the series under this title. While covering a wide range in North America, the majority of the species are from Mexico and Central America where the rust flora is much less known than in the North.

After an extended study of the spore development in *Philocopra coeruleotecta* Rehm, H. J. Sax in the *American Journal of Botany* for February concludes that the method of spore formation in the many-spored ascus is similar to that of the few-spored ascus. There is no indication of a phylogenetic relationship between the ascus and the sporangium of the phycomycetes.

In the January number of *Phytopathology,* L. M. Massey claims that a dust mixture consisting of 90 parts of sulphur and 10 parts of arsenate of lead is more effective in the control of powdery mildew of roses than a spray of lime-sulphur and is much less unsightly. The mixture acts both as a fungicide and an insecticide and is easier to handle than pure sulphur dust since the arsenate of lead keeps the sulphur from packing.

The *Annals* of the Missouri Botanical Garden for February contains a monograph of the genus *Rhizopogon* for North Amer-

ica. Twelve species and one variety are recognized, six of which are described as new. Fifteen extra-limital species are also described, two of which are listed as new. These are included in order to assist in determining material in case they are later found to occur in North America. The paper is illustrated with two plates.

The *Botanical Gazette* for May contains an article by J. C. Arthur on the "Uredinales of the Andes, Based on Collections by Dr. and Mrs. Rose." An estimate of the number of named species of rusts from the Andes is put at about 250, which is probably not half of the total number to be found. The Rose collection of Uredinales represents 40 numbers comprising 21 species of which about one fourth are described as new, a number rare, and one third common.

Professor H. H. Whetzel, leader of the plant-disease survey work of the state of New York in cooperation with the United States Department of Agriculture, is soliciting the collaboration of all institutions in the state which are interested in mycology or plant-disease work of any kind. The object of this work is to gain a detailed knowledge of the distribution and prevalence of the principal diseases of food-plants, which knowledge is to be used as a basis in waging a more intelligent campaign against such diseases and thereby increasing our food production.

THE PROPOSED ABSTRACT JOURNAL

A meeting of editors of botanical publications was held at Pittsburgh, on December 28, 1917, to consider the desirability of undertaking the publication of an abstracting journal for botany. After a long discussion the following resolution was adopted:

"*Resolved,* That we, as a group of botanists interested, invite each botanical society to appoint a committee of two to meet with committees of other societies and with the members of this group, to formulate a program for a journal of botanical abstracts, botany to be interpreted in its broadest sense. In case action of any society is delayed, the President and Secretary of such so-

citey are invited to represent it. A meeting is called for 10 a. m., December 30, at Parlor 140, Fort Pitt Hotel."

At this augmented meeting of December 30, after informal discussion, it was voted that the 26 botanists present proceed to formal organization under the "Temporary Board of Control of Botanical Abstracts." Donald Reddick was elected chairman and Forrest Shreve secretary. On motion it was voted that the board provide for its perpetuation in the following way:

1. That the following botanical organizations be asked to elect two members each:

American Association for the Advancement of Science, Section G.
American Genetic Association
American Microscopical Society
American Phytopathological Society
American Society of Agronomists
American Society of Naturalists
American Conference of Pharmaceutical Faculties
Botanical Society of America $\begin{cases} \text{General Section} \\ \text{Physiological Section} \\ \text{Taxonomic Section} \end{cases}$
Ecological Society of America
Paleontological Society of America
Society of Horticultural Science
Society of American Bacteriologists
Society of American Foresters

2. That in the election of members to the Board of Control of Botanical Abstracts each society be asked to name one man for a short term of two years and one man for a long term of four years, and that a member be elected biennially thereafter or as required.

On motion the Temporary Board of Control elected by ballot an executive committee of ten on organization, to act for one year with power to make arrangements for editorial management and publication. This committee is constituted, as follows:

J. H. Barnhart	Burton E. Livingston
Henry C. Cowles	F. C. Newcombe
B. M. Duggar	Donald Reddick
C. Stuart Gager	C. L. Shear
R. A. Harper	Forrest Shreve

The executive committee of the Temporary Board of Control selected B. E. Livingston for editor-in-chief and the following as associate editors in charge of the sections as indicated:

Agronomy and Soil Technology, ——[1]
Bacteriology, H. J. Conn
Botanical Education, C. Stuart Gager
Cytology, C. J. Chamberlain
Ecology and Plant Geography, Henry C. Cowles
Forestry, Raphael Zon
Genetics, G. H. Shull
History, Biography and Bibliography, J. H. Barnhart
Horticulture, W. H. Chandler
Morphology, E. W. Sinnott
Paleobotany, E. W. Berry
Pathology, Donald Reddick
Pharmacognosy, Henry Kraemer
Physiology, B. M. Duggar
Taxonomy, J. M. Greenman and J. G. Schramm

It is expected that the work of abstracting will begin at once, with the international literature of the year 1918, and that publication will follow promptly.

[1] Name to be supplied.

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MYCOLOGIA

VOL. X SEPTEMBER, 1918 No. 5

HYPHOLOMA AGGREGATUM AND H. DELINEATUM

EDWARD T. HARPER

(WITH PLATE 12)

Since I published the notes on the *Hypoloma lacrimabundum* group of Agarics in Trans. Wis. Acad. Sci. Arts and Letters, Vol. XVIII, p. 412, Prof. Beardslee of Asheville, N. C., has sent me specimens and photographs of two of Peck's species, *Hypholoma aggregatum* and *Hypholoma delineatum*, with the suggestion that the former is the same as *Hypholoma Storea* var. *caespitosum*, Cke. As this species is what Maire and others consider the true *Hypholoma lacrimabundum* of Fries and is at least a fine addition to my *Hypholoma lacrimabundum* group and as these specimens of *Hypholoma delineatum* clear up a doubtful point in my article I will publish a few notes on the species and also the photographs with the kind consent of Prof. Beardslee.

1. The identity of *Hypholoma aggregatum* Pk. and *Hypholoma Storea* var. *caespitosum* Cke.

I have never collected *Hypholoma aggregatum* but a comparison of Beardslee's specimens with *Hypholoma aggregatum* in Shear's N. Y. Fun. No. 13 and with *Hypholoma Storea* var. *caespitosum* in Jaap's exsicatti No. 143 shows that there is at least a very close relationship between the two forms. Beardslee's photograph accompanying this article is also very similar to W. G. Smith's illustration of *Hypholoma Storea* in the Jour. Bot., Vol 14, tab. 176. The latter represents the plant since determined as *Hypholoma Storea* var. *caespitosum*.

The species belongs to what I have called the *Hypholoma lacri-*

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mabundum group which now includes four or five well marked forms in the United States: the typical form illustrated in the Trans. Wis. Acad. Vol. XVII, pl. LXXVII, C, *Hypholoma echiniceps,* pl. LXXVIII, the present *H. Storea* var. *caespitosum,* the form called by Peck *H. aggregatum* var. *sericeum,* N. Y. State Mus. Bull. 54, p. 972, pl. 79, and the rugose form described as *H. delineatum.*

The characteristic mark of the group is the smooth purple-brown spores $3–5 \times 6–9\,\mu$. Peck gives for *Hypholoma aggregatum* $3–5 \times 6–9\,\mu$ and for var. *sericeum* $4 \times 7\frac{1}{2}\,\mu$. Beardslee's specimens agree with Peck's. Jaap gives for *Hypholoma Storea* var. *caespitosum* $4–4.5 \times 7.5–8\,\mu$. Atkinson's measurements of the spores of *Hypholoma echiniceps* are $3.5–5 \times 7–9\,\mu$. The spores of my specimens of this form agree, except that I found none over $8\,\mu$ long. Typical *Hypholoma lacrimabundum* had spores $4–5 \times 7–8\,\mu$ some of them shorter and broader, $5 \times 7\,\mu$, and somewhat triangular, suggesting *Hypholoma populinum* Britz. as noted below. W. G. Smith says the spores of *Hypholoma Pseudostorea* are $2.5–3 \times 5–7\,\mu$ and Plowright gives for *Hypholoma hypoxanthum* $4–5 \times 9–11\,\mu$. These two species are considered synonyms of *Hypholoma Storea* var. *caespitosum* and show the extreme variations in the size of the spores provided that the reports of the measurements are accurate.

I have illustrated the spores of this group in pl. 12, C, which shows spores from typical *Hypholoma lacrimabundum, Hypholoma echiniceps* and *Hypholoma Storea* var. *caespitosum.* They are very different from the large tuberculate apiculate spores of all forms of the *Hypholoma velutinum* group which are shown in pl. 12, E.

All the forms in the group agree in their essential characters. The gills are dark, clouded, and with white, floccose edges. They are usually weeping, though scarcely at all so in *Hypholoma Storea* var. *caespitosum.* They become black with age. The surface of the pileus is innate fibrous and usually tears into tufts of fibers which are darker colored than the background. The stem is hollow and more or less scaly like the pileus. The gills are adnexed and the flesh is solid and whitish.

The forms differ in size, more or less caespitose habit, shade

of color and especially in the surface of the pileus. It is finely appressed-scaly in *Hypholoma lacrimabundum*, more coarsely squarrose in *H. echiniceps*, has fewer and larger patches of fibers in *H. Storea* var. *caespitosum*, is nearly smooth in *H. aggregatum* var. *sericeum*, and rugose in *H. delineatum*, if that species proves to belong to this group.

The variation in the group in Europe appears similar to that in this country. Plowright in the Trans. Brit. Myc. Soc. 1898, p. 45, considered *Hypholoma Storea* of Cooke's illustration 543 identical with *Hypholoma lacrimabundum* as illustrated in Fries' Icon. 134. W. G. Smith, however, in Jour. of Bot., 1903, p. 386, said that the gills of the former species do not weep and made it a new species *Hypholoma Pseudostorea*. He was followed by Rea in Trans. Brit. Myc. Soc., 1904, p. 65. Maire in the Bull. Soc. Myc. de France, 1911, pp. 41–42, supports Plowright's view and considers the weeping of the gills of little importance. Cooke did not admit that *Hypholoma lacrimabundum* and *Hypholoma Storea* var. *caespitosum* were the same species. If we compare the illustrations of Fries and Cooke with our plants and remember that Peck does not report the gills of *Hypholoma aggregatum* as weeping we conclude that about the same difference exists between the forms in the group in Europe as in this country. Some are larger and less caespitose with the pileus finely scaly and some are more densely caespitose with the pileus coarsely scaly. The former are typical *Hypholoma lacrimabundum* and the latter *Hypholoma Storea* var. *caespitosum* of Cke or *Hypholoma aggregatum* of Peck. A further hint of agreement between our forms in the group and those in Europe is the triangular shape of some of the spores in typical *Hypholoma lacrimabundum* which Maire has also noted and which he says is the only distinction between *Hypholoma lacrimabundum* and *Hypholoma populinum* Britz. The relation of species like *Hypholoma silvestre* Gill. and of *Hypholoma Storea* itself to the group needs further investigation.

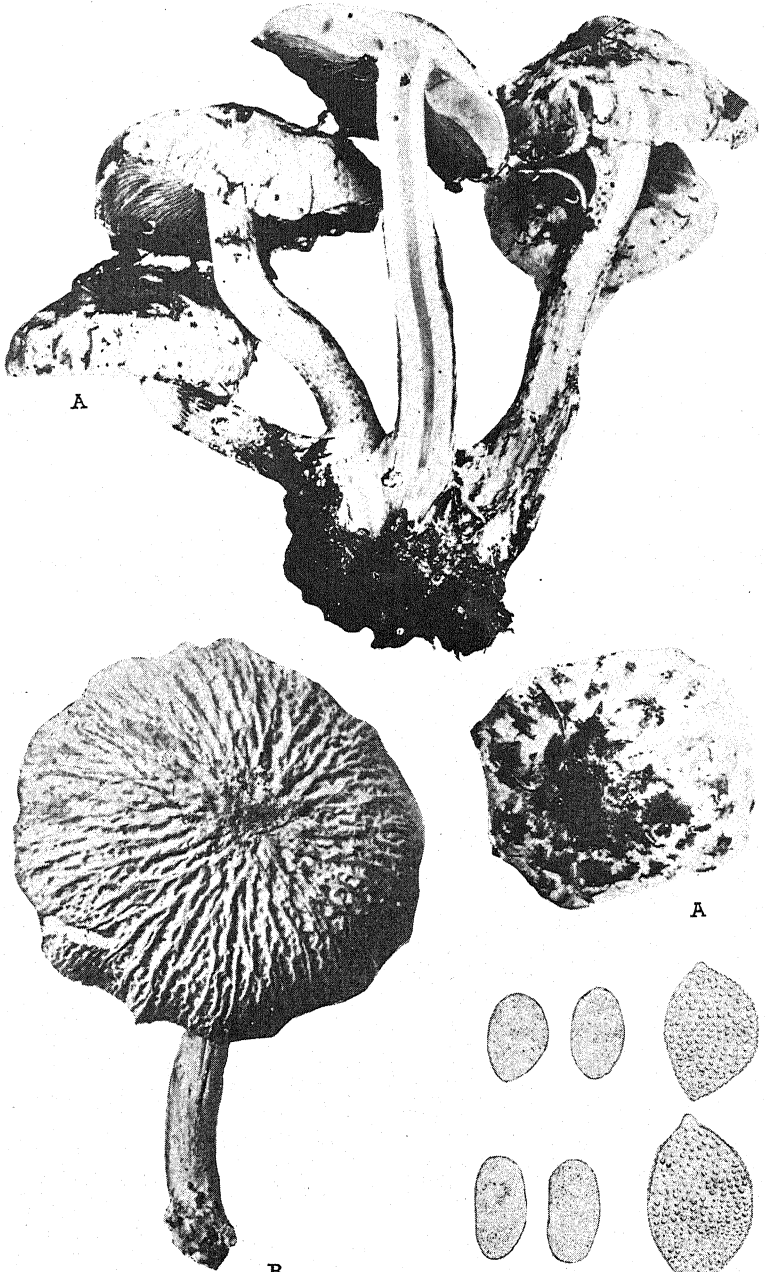
The desirability of placing all the forms of the group together is evident. Peck's assignment of *Hypholoma aggregatum* to the section *Flocculosa* while *Hypholoma lacrimabundum* is placed in the section *Velutina* is most misleading. On the other hand, Maire's bunching all the forms together as one species loses sight of im-

portant distinctions which are of great use in comparing the floras of different countries and habitats and in understanding the variability of the groups. A proper arrangement should recognize the fact that plants exist in varying groups, each containing a multitude of forms due to many different causes and that the groups are separated by gaps which have arisen in various ways during the history of development.

2. *Hypholoma delineatum* Pk. There appears to be no doubt that Beardslee's specimens, one of which is shown in pl. 12, B, are *Hypholoma delineatum* Pk. They are true species of *Hypholoma* with dark purple-black spores and fragments of the veil about the margin of the pileus. They confirm my opinion in note 2 on p. 413 of the article quoted above that the plant illustrated in Plate XXI is not a *Hypholoma* but probably belongs to the *Pholiota erebia* group and they also suggest that Peck's *Hypholoma delineatum* is a form of the *H. lacrimabundum* group. The spores are the same size and shape as those in the *H. lacrimabundum* group, Plate 12, C. They measure $4–5 \times 7–8\,\mu$ in Beardslee's specimens; Peck gives $4–6 \times 8–10\,\mu$. Peck placed the species after *H. rugocephalum* because the pileus was rugose wrinkled. Forms with rugose wrinkled pilei and similar in general appearance occur in several groups. There is one in the *Pholiota erebia* group illustrated in Trans. Wis. Acad., Vol. XVII, pl. LXXXIV, E. It occurs both in this country and in Europe; one in the *Hypholoma velutinum* group which Atkinson named *H. rugocephalum,* Trans. Wis. Acad., Vol. XVIII, pl. XX; and there is the typical form of the *Cortinarius corrugatus* group. The surface of the pileus in the last species is exactly like that of *H. delineatum* which Peck describes as "marked toward and on the margin even when dry with irregular radiating lines or ridges." But the color of the gills and the large tuberculate spores, $10–11 \times 12–14\,\mu$, easily distinguish *Cortinarius corrugatus*.

Peck's description of *Hypholoma delineatum* is in the N. Y. State Mus. Bull. 150, pp. 83–84.

GENESEO, ILL.



A. HYPHOLOMA AGGREGATUM PECK
B. HYPHOLOMA DELINEATUM PECK
C. SPORES OF H. LACRIMABUNDUM GROUP
D. SPORES OF H. VELUTINUM GROUP

A NEW GENUS AND SPECIES OF THE COLLEMACEAE[1]

Bruce Fink

(With Plate 13)

In 1912 and 1913 (1 and 2), Freda M. Bachman published two papers in which a new form of male reproductive tract and a peculiar behavior of the trichogyne were described. During the progress of Miss Bachman's investigations, the writer had her material under observation several times and was convinced that she was working on the classical *Collema pulposum* (Bern.) Ach., until the sexual reproductive tracts and their behavior had proved to be very different from those known to exist in that lichen (Cf. pl. 13, f. 1, 2, 3, and 4, with f. 5 and 6, with respect to size and manner of occurrence).

When we recall that, in these lichens imbedded in gelatinous *Nostoc* colonies, we see with the eye only the modified algal-host colonies in which the lichen lives and the fruit of the lichen, and that the apothecia and the spores are much alike in several different species of the Collemaceae, it does not seem strange that two lichens, perfectly distinct with respect to sex organs and their behavior, should have very similar apothecia and spores, and should produce very similar modifications of the algal-host colonies. But this does not justify placing plants with very different types of male reproductive tracts and corresponding difference in the behavior of the female reproductive tracts in the same genus and species.

During the years 1912 to 1915, when the writer and Miss C. Audrey Richards were at work on the Collemaceae of Ohio (3), Miss Richards, who was doing the microscopic work, found the peculiar male reproductive tracts several times in material which we had previously taken for *Collema pulposum* (Bernh.) Ach. The lichen just mentioned was also found frequently in the speci-

[1] Contributions from the Botanical Laboratory of Miami University.—XIV.

mens studied, and the similar effect produced on the algal host by the two lichens, together with their similarity with respect to apothecia and spores, led to the suspicion that the plants might after all belong to the same species, the internal spermatia being conidia, with which the trichogynes fused in some instances instead of with the spermatia produced in spermagonia. Though this possibility was kept in mind in the examination of material, in no instance were spermagonia and the free internal spermatia found on the same plants, or in plants belonging to the same collection.

Before studying the Ohio material, it had been ascertained that the material widely distributed by the writer from Fayette, Iowa, in 1894 and following years, as *Collema pulposum* (Bernh.) Ach. was not that lichen but the new and peculiar one studied first by Miss Bachman and described in the present paper. After working on the Ohio material, the specimens in the writer's herbarium were gone over with the result that the new plant was found from widely separate stations, extending from the Atlantic coast to areas west of the Mississippi River.

On account of the similar modification of the algal-host colony and the likeness with respect to apothecia and spores between the plant described below and certain species of Collema, especially *Collema pulposum* (Bernh.) Ach., one can never hope to make sure whether he has our plant or a *Collema,* without ascertaining the morphology of the male reproductive tract, and the behavior of both male and female reproductive tracts. In these respects it must be remembered that our plant has internal, much larger spermatia, not contained in spermagonia and that the trichogynes grow to the spermatia within the thallus; while in the Collemae the trichogyne extends above the surface of the thallus, and the much smaller spermatia escape from the superficial spermagonia and are carried to this exposed portion of the female reproductive tract.

Collemodes gen. nov.

Transforming the algal-host colonies into foliose bodies; thallus wholly mycelial, imbedded in the host colonies, and attached to the substratum by rhizoids; male reproductive organs not in

spermagonia, but occurring internally in groups of several individuals (pl. 13, f. 2, 3, and 4).

Collemodes Bachmanianum sp. nov.

Transforming the algal-host colony into a middle-sized, orbicular or irregular body, which is 1.4 to 7 cm. across and 375 to 850 mic. thick, and closely attached to the substratum, with entire or repand crenate, often imbricate lobes, which are olive varying toward blue or black and scarcely lighter below, the marginal ones often with strongly ascending or even erect borders, while the central ones are usually flat, and with the algal-host colonies more numerous toward the surfaces; thallus of variously disposed hyphae, more densely placed under and about the apothecia where they are straight or wavy and usually stand roughly perpendicular to the disk; rhizoids many and for most part disposed in groups at the various points of attachment to the substratum; ascogonia occurring singly or in groups of 2 to 4 from 100 to 160 mic. below the upper surface of the thallus, each ascogonium of 2 to 4 coils, which contain 6 to 12 cells (pl. 13, f. 1 and 4); the trichogynes passing in various directions (pl. 13, f. 1 and 4) usually toward groups of internal spermatia; spermatia commonly found in groups of 3 to 15, and 100 to 300 mic. below the upper surface of the thallus, the groups arranged on the sides or the ends of small and often irregular hyphae, the spermatium oblong-clavate, 6 to 14 mic. long and 2 to 3 mic. wide; apothecia many, adnate or sessile, scattered or thickly disposed over the central portion of the thallus, 0.5 to 4.5 mm. across; disk red-brown, concave or rarely becoming flat or slightly convex, surrounded by an entire or a rugose-crenate thalliod margin, which extends slightly above the disk; exciple thin, composed of interwoven hyphae, hyaline or light-brown; hypothecium hyaline to light-brown, composed of interwoven hyphae, 45 to 80 mic. thick; hymenium hyaline below to brown above, 135 to 165 mic. thick; asci cylindrico-clavate, 100 to 120 mic. long and 20 to 30 mic. wide; spores hyaline, ellipsoid, muriform, longitudinally 4 to 5-celled and transversely 1 to 2-celled, 8 in each ascus.

Examined from Iowa (Fink), Minnesota (Fink), Wisconsin

(Bachman), Ohio (Fink), Missouri (Russell), and New York (Burnham).

The writer is under obligations to his former pupil, Miss C. Audrey Richards, for the drawings which accompany this paper.

MIAMI UNIVERSITY,
OXFORD, OHIO.

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EXPLANATION OF PLATE 13

Fig. 1. An archicarp of *Collemodes Bachmanianum,* the trichogyne of which extended roughly parallel with the surfaces of the thallus. × 580.

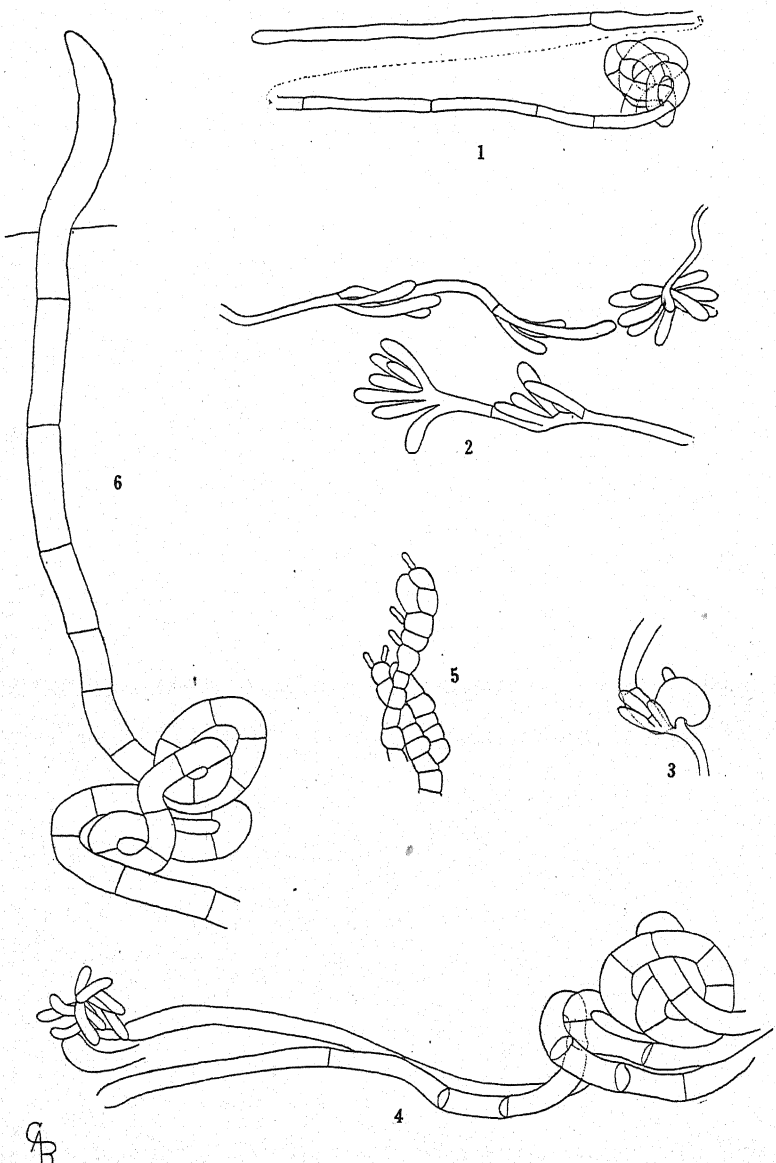
Fig. 2. Several groups of internal spermatia of *Collemodes Bachmanianum,* with the hyphae upon which they are borne. × 1,000.

Fig. 3. A group of four internal spermatia of *Collemodes Bachmanianum* with the swollen tip of a trichogyne applied to one of them. × 1,000.

Fig. 4. Two ascogonia of *Collemodes Bachmanianum* at the right, and two trichogynes extending toward a group of internal spermatia. × 1,000.

Fig. 5. Portions of three basidia of *Collema pulposum* with five spermatia attached. × 1,000.

Fig. 6. An archicarp of *Collema pulposum,* the trichogyne of which extends above the thallus. × 1,000.



FIGS. 1–4. COLLEMODES BACHMANIANUM FINK
FIGS. 5, 6. COLLEMA PULPOSUM (BERNH.) ACH.

NEW OR NOTEWORTHY ASCOMYCETES AND LOWER FUNGI FROM NEW MEXICO

CHARLES EDWARD FAIRMAN

The following notes are based upon a collection of microscopic fungi from New Mexico by Paul C. Standley. The specimens were mostly gathered by Mr. Standley in the vicinity of Ute Park, Colfax County, at an altitude of 2200 to 2900 meters during August and September, 1916. A few were collected at other places, especially at Baldy Peak, above timber line, at an altitude of 3600 meters. The details of the trip have been personally narrated by Mr. Standley in *Mycologia* **10**: 34. The numbers in parenthesis are the collection numbers. Where no locality is mentioned in the text Ute Park is the place of collection. Prof. John Dearness has examined numbers 14253, 14565, 14754, 14772 and 14780, and the writer is deeply indebted to him for assistance.

ASCOMYCETES

Order: SPHAERIALES

Family: ERYSIBACEAE

PHYLLACTINIA CORYLEA (Pers.) Karst.

On bare wood of dead branches of *Alnus tenuifolia* Nutt. (14772 p.p.).

The occurrence of this fungus on bare wood is noteworthy. A severe infection of the leaves of trees by members of the Erysibaceae is often followed by an extension of the disease to surrounding objects. The writer has for several years noticed a tree of horsechestnut which is subject to annual attacks of *Uncinula flexuosa* Peck. Underneath this tree a species of *Corticium* upon fallen branches, and leaves of cultivated rhododendrons are found with a similar infection by contiguity.

On blackened areas around the base of branchlets there were a

few perithecia of a *Thyridium* with 5–6-septate, muriform ascospores, 24–26 × 6–9 μ, evidently near *T. cingulatum.*

SPHAEROTHECA HUMULI (DC.) Burrill

On leaves of *Heuchera parvifolia* Nutt. (13803).

Family: SPHAERIACEAE

ALLANTOSPORAE

EUTYPELLA HERBICOLA E. & E.

On old stems of *Artemisia frigida* Willd. (14745) and *Atriplex canescens* (Pursh) Nutt. (14715).

Eutypella Brunaudiana Ribis-aurei var. nov.

Pseudostromata scattered or gregarious, base discoid or angular, seated on the inner bark, finally erumpent and girt by the ruptured epidermis, 1–4 mm. in diam., imperfectly circumscribed by a black line, and when maturely erumpent presenting a roughened black disc; perithecia 4–20, globose or angular, with very thick walls and a waxy, glistening, *Massaria*-like aspect upon section, 300–500 μ in diam., black; ostiola short, obese, obtuse at the apex, roughening the disc; asci narrow, clavate, long-pedicellate, 8-spored, 75 × 6.75–10 μ; spores 8, irregularly biseriate, allantoid, hyaline, 10–13.5 × 3–4 μ, with a nucleus in each end.

On old branches of *Ribes aureum* Pursh (14736).

Diatrype Standleyi sp. nov.

Stromata scattered, at times coalescent, small, pulvinate or verruciform, 1–5 mm. in length, acute-ellipsoid or lanceolate, immersed, then erumpent, internally, at first, of a dirty-white tint, becoming rusty in spots and finally brown, externally roughened, black; perithecia 1–15, subcircinately or irregularly arranged, .25–.5 mm. in diam., walls thick, ostiola projecting, radiately cleft, roughening the disc; asci clavate, long stipitate, 8-spored, 70–125 × 7–8 μ; spores allantoid, biseriate above, uniseriate toward the narrowing stipe, straight or curved, hyaline then yellowish, 10–13 × 3–3.5 μ.

On dead branches of *Cercocarpus montanus* Raf. (13659 p.p. and 14789).

Externally this resembles *Diatrype cornuta* E. & E., but the stroma is differently tinted, and the asci and spores are larger.

DIATRYPE ALBOPRUINOSA (Schw.) C. & E.

On dead branches of *Acer neomexicanum* Greene (14683 p.p.) and on old scrub oak branches (*Quercus Fendleri* Liebm. ?) (13660 and 14693 p.p.).

DIATRYPELLA PLACENTA Rehm.

On dead branches of *Alnus tenuifolia* Nutt. (14771). Agrees with specimens in Rehm's Ascomyceten, No. 1984 and Tranzschel and Serebrianikow, Mycotheca Rossica, No. 225.

HYALOSPORAE

PHYSALOSPORA GALII Rostr.

Perithecia gregarious, single or 2–4 in a cluster, lenticular or globose-depressed, membranaceous and of loose cellular structure, surrounded at base by brown mycelial hyphae, often seated on yellow or brown discolored areas, immersed, then erumpent, opening by a central pore, black or brown, 100–200 μ in diam.; asci oblong, broad, rounded at both apex and base, 8-spored, 40–44 $\times$ 10–13.33 μ; spores obliquely biseriate or crowded, fusoid-oblong or cymbiform, mostly rounded at the ends, one end apt to be a little broader, simple, continuous, minutely granular or nucleolate, hyaline, 13–17 $\times$ 3.33–6 μ; paraphyses few, filiform.

On old stems of *Galium boreale* L. (14757 p.p.).

The broad asci differ from Rostrup's original description (Bidr. Ascom. Dovr. in Kristiana Videnskabs-Selskabs Forhandl. 9: 7. 1891. Accompanied by a *Phoma* and *Rhabdospora* too scanty for determination, and **Microdiplodia galiicola** sp. nov.

PHAEOSPORAE

ROSELLINIA PARASITICA E. & E.

On old stems of *Grossularia leptantha* (Gray) C. & B. (14674 p.p.).

ROSELLINIA PULVERACEA (Ehr.) Fckl.

On old log of *Populus angustifolia* James (13562 p.p.) and on *Quercus Fendleri* Liebm. (14722 p.p.).

ROSELLINIA ROSARUM Niessl

On dead branches of *Rosa* (14763 p.p.).

HYALODIDYMAE

MYCOSPHAERELLA IRIDIS (Awd.) Schröt.

On leaves of *Iris missouriensis* Nutt. (13615).

MYCOSPHAERELLA TINGENS Niessl?

On old leaves of *Arenaria Fendleri* Gray (14363 a).

Asci $67 \times 17\,\mu$; sporidia oblong, rounded at the ends, uniseptate, one cell narrower, greenish hyaline, 24×6–$7\,\mu$. The spores are larger than those in the description and the discolored spots on the leaves are rarely present.

MYCOSPHAERELLA PACHYASCA Rostr.

On old stems of *Agoseris* (13731) and on old leaves of *Mertensia caelestina* Nels. & Cockerell.

MYCOSPHAERELLA PRIMULAE (Auersw. & Heufl.) Schröt.

On old stems of *Androsace diffusa* Small (14174).

Didymella nigrescens Dearness & Fairman sp. nov.

Perithecia black, shining on the summit, rather thickly scattered in the darkened surface of the decorticated branchlets, conoid or depressed-globose, base thin or almost disappearing, sunk in the unaltered wood, the ostiolum only, or up to half of the wall, erumpent, .25–.4 mm. in diam.; ostiola minute, round, often in an umbilicate depression; asci clavate-cylindric, obtuse at apex, short-stipitate, 8-spored, 65–90×7–$10\,\mu$; paraphyses simple, abundant, longer than the asci; spores hyaline, inequilateral, oblong-fusoid, biseriate above, 1-septate, constricted, upper cell larger, sometimes a gutta in each cell, 10–13×3.5–$4.5\,\mu$.

On old branches of *Symphoricarpos oreophilus* Gray (14754 p.p.).

DIDYMELLA NIGRIFICANS Karst.

On old branches of *Rosa* (14761).

Didymella Eurotiae sp. nov.

Perithecia scattered or gregarious, at first covered by the epidermis, becoming erumpent, finally adnate-superficial, globose, with minute papilliform ostiola, .3–3.5 mm. in diam., dull black; asci clavate-cylindric, rounded at the apices, long-stipitate, 8-spored, $133 \times 10\,\mu$; spores oblong-fusoid, uniseptate, slightly constricted at the septum, obliquely uniseriate, each cell with a large nucleus, hyaline, $20–23 \times 6–7\,\mu$.

On old branchlets of *Eurotia lanata* (Pursh) Moq. (14791 p.p.).

A *Pleospora* and a *Phoma* in small quantities are associated with the above.

Apiosporella cornina sp. nov.

Perithecia scattered or gregrarious, depressed-globose or markedly flattened, at first covered by a thin layer of the epidermis, suberumpent, elevating the epidermis in minute pustules, black, $200–250\,\mu$ in diam.; asci clavate-cylindric, short-stipitate, rounded at the apex, 8-spored, $40–50 \times 13–15\,\mu$, surrounded by filiform paraphyses; spores irregularly biseriate, oblong-obovate, subrotund at the ends, uniseptate, the septum being formed about one third the way up from the base, not constricted, the upper cell twice as large as the lower, hyaline then golden-yellow, $20–23.33 \times 6.66–7\,\mu$.

Differs from *Apiospora sepincoliformis* (DeNot.) Trav. in the spores, which are larger, with a subellipsoid but not cuneiform base, and with the septum formed farther from the end. In the generic name the writer follows von Höhnel, who (Fragmente, VIII, No. 389), referring *Apiospora* to the *Dothideales*, institutes the genus *Apiosporella* for *Apiosporae* without a stroma. Because the spores of *Apiosporella cornina* become yellow at maturity, those mycologists who do not refer to the hyaline-spored sections any fungus which has a more or less decided tint to the spores would, perhaps, refer our plant to *Phaeoapiospora* Sacc. & Syd., a genus tentatively proposed in Sacc. Syll. XVI, 477. But von Höhnel, loc. cit., considers the species described in the

Sylloge as *Phaeoapiosporae* to be *Didymosphaeriae* with unequal spore cells.

CERIOSPORA DUBYI Niessl

On old stems of *Humulus americanus* Nutt. (14564 p.p.). Host new.

CERIOSPORA MONTANIENSIS E. & E.

On old stems of *Clematis ligusticifolia* Nutt. (13679 p.p.).

MELANOPSAMMA POMIFORMIS (Pers.) Sacc.

On a log of *Populus angustifolia* James (13552).
This is the var. *minor* of Saccardo.

DIAPORTHE OLIGOCARPOIDES Rehm

Asci clavate-cylindric, rounded at the apex, short-stipitate, 8-spored, $73–80 \times 7–8\,\mu$, paraphyses not seen; spores uniseriate, oblong-ellipsoid, uniseptate, not constricted, one or two oil-drops of varying magnitude in each cell, $10–12 \times 3.33–4\,\mu$.

Differs slightly from the description in subcylindric, unconstricted and broader spores. Probably unreported from the United States. On old stems of *Rosa* (14761).

PHAEODIDYMAE

OTTHIA FRUTICOLA E. & E.

Otthia Clematidis Earle?

On old stems of *Clematis ligusticifolia* Nutt. (14565 p.p.).

PHAEOPHRAGMIAE

LEPTOSPHAERIA DUMETORUM Niessl

On old stems of *Ratibida columnifera* (Nutt.) Woot. & Standley (14742), on old stems of *Nuttalia Rusbyi* (Woot.) Cockerell (14770), on old stems of *Agrimonia striata* Michx. (14731), and on old stems of *Melilotus alba* Desr. (14783). Also on old stems of *Senecio scopulina* Greene (14583) with a *Rhabdospora* which may be connected with it presenting the following characteristics.

Pycnidia scattered or gregarious, immersed, becoming erumpent-superficial, centrally ostiolate, globose-depressed, black, 100–150 μ in diam.; spores filiform, straight or curved, simple, continuous, hyaline, about 27–30 $\times$ .5–1 μ, **Rhabdospora dumetorum** sp. nov.

LEPTOSPHAERIA DOLIOLUM (Pers.) DeNot.

On old stems of *Heliopsis scabra* Dunal (13653).

Leptosphaeria nigricans Grindeliae var. nov.

Perithecia scattered or gregarious, on blackened areas on the stems, depressed-globose, finally collapsing, flattened, or subumbilicate, black, 250–300 μ in diam.; asci clavate-cylindric, rounded at the apex, short-stipitate, 8-spored, 70–100 $\times$ 10 μ, surrounded by numerous filiform paraphyses; spores subbiseriate, 3–5-septate, slightly constricted at the middle septum, oblong-fusoid, hyaline at first, becoming yellow or greenish-yellow, 23–27 $\times$ 3.33–4 μ.

Differs from *Leptosphaeria nigricans* Karst. (of which *Leptosphaeria tenera* Ellis is a small-spored form) in gregarious, collapsing perithecia.

LEPTOSPHAERIA OGILVIENSIS (B. & Br.) Ces. & DeNot.

On old stems of *Pericome caudata* Gray (14599), on old stems of *Machaeranthera Bigeloviae* (Gray) Greene (14739), and on old stems of *Delphinium robustum* Rydb. (13664).

LEPTOSPHAERIA PRAECLARA TYPHISEDA (Sacc. & Berl.) Berl.

On old stems of *Typha latifolia* L. (14746).

LEPTOSPHAERIA CULMIFRAGA MINUSCULA Rehm.

On old stems of *Elymus canadensis* L. Spores 6–8-septate, 30 $\times$ 3.33 μ.

LEPTOSPHAERIA LUPINCOLA Earle, Pl. Bak. 2: 20. 1901

On old stems of *Lupinus ingratus* Greene. This is in limited quantity, for the most of this collection (14678) is a *Phoma* with

oblong, guttulate spores, $6 \times 1.5–2\,\mu$, apparently different from *Phoma lupincola* Earle from Durango, Col. No. 14678 has, also, a few scattered perithecia of *Pleospora herbarum* (Pers.) Rabh., the typical form as noted by Earle, loc. cit., p. 22.

Leptosphaeria Quamoclidii sp. nov.

Perithecia scattered, globose or globose-conoid, with a minute papilliform ostiolum, black, $200–250\,\mu$ in diam.; asci cylindric, rounded at the apex, short-stipitate, 8-spored, $80–100 \times 7\,\mu$; spores overlapping uniseriate, oblong-fusoid, 3-septate, slightly constricted at the septa, 4-guttulate, $13–17 \times 6\,\mu$, brown.

On old stems of *Quamoclidion multiflorum* Torr. (14790 p.p.).

Leptosphaeria Coleosanthi sp. nov.

Perithecia scattered, immersed, becoming erumpent-superficial, globose or globose-depressed, with a more or less elongated papilliform ostiolum, which as a rule just protrudes, black, 250–$350\,\mu$ in diam.; asci clavate-cylindric, varying from short to long-stipitate, 8-spored, $90–135 \times 10–12\,\mu$; spores irregularly biseriate, fusoid, 3–5-septate, not markedly constricted, yellow or yellowish-brown, $40–50 \times 3.33–4\,\mu$; paraphyses numerous, filiform.

On old stems of *Coleosanthus reniformis* (Gray) Rydb. (14597).

LEPTOSPHAERIA HELIANTHI E. & E.

On *Helianthus Maximiliani* Schrad. Immature and doubtful (14659).

LEPTOSPHAERIA RUBROTINCTA E. & E.

Spores fusoid, curved, multiseptate, about $60 \times 4\,\mu$, these dimensions agreeing with those of Berlese (Berlese, Ic. Fung. fasc. 2: 84 and tab. LXXVI, fig. 2), who says "et usque $60\,\mu$ longa."

On *Ligusticum Porteri* C. & R. (14651).

Gibberidia arthrophyma sp. nov.

Perithecia densely cespitose, erumpent through acutely ellipsoid clefts of the outer bark, globose, externally rugose, minutely

and centrally ostiolate, often somewhat umbilicate around the ostiola, dull-black, 250–300 μ in diam.; asci clavate-cylindric, rounded at the apex, short-stipitate, 8-spored, 100 × 10–12 μ; spores irregularly biseriate, very rarely uniseriate, oblong-fusoid, 4-septate, constricted more strongly at the third septum, the upper portion of the spore larger and trilocular, the lower bilocular, the third or middle cell markedly enlarged, straight or curved, obtuse at the ends, hyaline at first, finally yellow or pale-brown, 20–23 × 7 μ.

On old stems of *Chrysothamnus graveolens* (Nutt.) Greene (14782). Accompanied by a *Phoma* whose pycnidia are black, 150–250 μ in diam. filled with round or oblong, hyaline, nucleolate spores, 3.3–4.5 × 3.3 μ.

PHAEODICTYAE

PLEOSPORA BARDANAE Niessl

On *Isocoma heterophylla* (Gray) Greene, Bueyeros, Sept., 1916, Father A. Estrelt.

PLEOSPORA COMPOSITARUM Earle

On old stems of *Kuhnia rosmarinifolia* Vent. (14718).

Spores 6–7-septate, muriform, 20–23 × 10 μ. This is probably the small-spored form on *Compositae* noted by Earle (Pl. Bak. 2: 21) but it is doubtfully distinct, and may be *Pleospora herbarum* f. *microspora* Sacc.

PLEOSPORA HERBARUM (Pers.) Rabh.

On old leaves of *Arenaria Fendleri* Gray (14363 a), on old stems of *Chrysopsis hispida* (Hook.) Nutt. (14721), on *Laciniaria punctata* (Hook.) Kuntze (14793), on old stems of *Potentilla filipes* Rydb. collected at Baldy Peak (14368 a), on old stems of *Allionia linearia* Pursh (14788), and on old stems of *Lithospermum multiflorum* Torr. (14716). From Baldy Peak there were two collections of the large spored form, viz., on old leaves of *Trifolium nanum* Torr. (14325) with spores 6–7-septate, 36–40 × 13.33 μ and on *Trifolium stenolobum* Rydb. (14328 a) with spores 7–9-septate, 30–40 × 13–17 μ.

PLEOSPORA COLORADENSIS E. & E.

On old stems of *Polemonium confertum* Gray (14159).

PLEOSPORA VULGATISSIMA Speg.

Asci clavate-cylindric, short-stipitate, 8-spored, 80–85 × 20 μ; spores irregularly biseriate or crowded, constricted only at the middle septum, 3–7-septate, muriform, the upper part of the spore larger and more obtuse, yellowish-brown to dark-brown, 20–36 × 10 μ.

On *Baccharis Wrightii* Gray (13801). Doubtfully distinct from some forms of *P. herbarum.*

PLEOSPORA VULGARIS Niessl

Pleospora Senecionis Earle (Pl. Bak. **2**: 22) 1901, not *Pleospora Senecionis* Fckl., 1869 (Symb. Mycol., p. 136) which is *Metasphaeria Senecionis* Sacc. (*Leptosphaeria Senecionis* Wint.).

On old stems of *Senecio amplectens* Gray, Baldy Peak (14310 a).

PLEOSPORA INFECTORIA Fckl.

On old leaves of *Danthonia intermedia* Vasey, Baldy Peak (14312 p.p.). Berlese reduces the preceding species to this.

PLEOSPORA RUBICUNDA Niessl

On old stems of *Typha latifolia* L. (14746 p.p.).

CLATHROSPORA PERMUNDA (Cooke) Berl.

On *Sporobolus auriculatus* Vasey (13617), on *Lycurus phleoides* H.B.K. (15573) and *Allionia linearis* Pursh (14788 p.p.).

PYRENOPHORA CHRYSOSPORA POLARIS Karst.

On old stems of *Psoralea tenuiflora* Pursh (14786) and on old stems of *Mertensia caelestina* Nels. and Cockerell (14329 a, p.p.) from Baldy Peak.

PYRENOPHORA COMATA (Awd. & Niessl) Sacc.

On old stems of *Petalostemum oligophyllum* (Torr.) Rydb. (14719 p.p.). Associated with *Hendersonia Petalostemonis*.

Pyrenophora Leucelenes sp. nov.

Perithecia black, minute, 100–150 μ in diam., scattered, immersed, becoming erumpent-superficial, globose, crowned with a few short, stout setae, brown at base, hyaline at tips, straight and rigid, 20–70 μ long and 3–4 μ broad; asci obovate, rounded at apex, short-stipitate, 8-spored, 80–85 $\times$ 30–33 μ; spores irregularly tristichous or conglobate, 6–7-septate, constricted at the middle septum, upper half of the spore more obtuse, the obtuse portion with bulging episporic wall from the middle septum up to the second septum from the middle, cells divided by 1–3 longitudinal septa, yellow at first, becoming dark-brown and finally opaque, 30 $\times$ 13-33 μ.

Distinguished by minute perithecia, short, broad asci and bulging-walled spores.

On stems and leaves of *Leucelene arenosa* Heller (13572). Accompanied by several deuteromycetes which may be stages of the development of the *Pyrenophora.* Inasmuch as these fungi imperfecti are so minute, and the leaves and stems of the host also, it was not practicable to separate them and all are included in one packet. It seems best, therefore, to describe them in this connection.

1. **Hendersonia Leucelenes** sp. nov.

Pycnidia scattered, globose-depressed, black, about 250 μ in diam.; spores oblong, straight or curved, varying from obtuse to subacute at the ends, 3-septate, not markedly constricted, hyaline and nucleolate at first, becoming brown, 10–14 $\times$ 4–6 μ; basidia inconspicuous.

2. **Microdiplodia Leucelenes** sp. nov.

Pycnidia immersed or suberumpent, globose or globose-depressed, brown or blackish, 100 μ in diam.; spores numerous, exuded in a mucous mass, oblong or ellipsoid, uniseptate, not constricted, ends rounded, 7–9 $\times$ 3–4 μ, brown, with basidia concealed by mucus.

3. PHOMA near P. HERBARIUM

Hab. of Nos. 1, 2, and 3, *Leucelene arenosa* Heller.

TEICHOSPORA RHOINA (Earle)

Strickeria rhoina Earle in Pl. Bak. **2**: 16. 1901.

On old branches of *Schmaltzia Bakeri* Greene (14756).

Spores 5–7-septate, 23–30 × 10 μ, muriform.

Teichospora rhypodes, Teichospora rhoina and *Teichospora stenocarpa,* all found on *Rhus,* vary so little as to render it probable that they represent one species.

Teichospora Cercocarpi (Earle)

Strickeria Cercocarpi Earle, Pl. Bak. **2**: 14.

On dead branches of *Cercocarpus montanus* Raf. (13659 p.p.).

TEICHOSPORA OBDUCENS (Fr.) Fckl.

On *Quercus Fendleri* Liebm. (14722).

TEICHOSPORA PYGMAEA E. & E.

On old log of *Populus angustifolia* James (13562).

CUCURBITARIA RIBIS Niessl

On old stems of *Grossularia leptantha* (Gray) C. & B. (14674), sparingly, also, on denuded places on branches of *Ribes aureum* Pursh (14736).

CUCURBITARIA ROSAE Wint. & Sacc.?

On dead branches of *Rosa* (14763 p.p.).

SCOLECOSPORAE

OPHIOBOLUS CLAVIGER Harkn.

On old stems of *Artemisia scouleriana* (Besser) Rydb. (14753).

OPHIOBOLUS COLLAPSUS Sacc. & Ellis

On old stems of *Verbena Macdougalii* Heller (13644).

Family: HYPOCREACEAE

SPERMOEDIA CLAVUS (DC.) Fr.

On *Agropyron Smithii* Rydb. (13749) and *Agropyron tenerum* Vasey (13747).

Family: DOTHIDEACEAE

PHYLLACHORA AMBROSIAE (B. & C.) Sacc.

Physalospora Ambrosiae E. & E., *Physalospora Arthuriana* Sacc.
On leaves of *Helianthus Maximiliani* Schrad. (13565).

PHYLLACHORA TRIFOLII (Pers.) Fckl.

On *Trifolium Fendleri* Greene (13546), sterile.

PHYLLACHORA VULGATA Theiss. & Sydow

On *Muhlenbergia cuspidata* (Torr.) Rydb. (14079) and on *Muhlenbergia trifida* Hac. (14183).

Phyllachora Blepharoneuri sp. nov.

Stromata visible on both sides of the leaves, elongate, slightly arched, in the process of growth elevating the nerves of the leaves thereby forming an epistromatic ridge, the ridge often remaining as a persistent, undestroyed septum between the loculi, 1–3 mm. long, 1 mm. broad, black; loculi rounded, 2–10 or possibly more in a stroma; asci and paraphyses as in *P. graminis;* spores monostichous, ellipsoid, eguttulate, hyaline, 10×6–$7\ \mu$.

On leaves of *Blepharoneuron tricholepis* (Torr.) Nash (13662).

EURYACHORA BETULINA (Fr.) Schr.?

On leaves of *Betula fontinalis* Sarg. (14662). Immature.

DOTHIDELLA INSCULPTA (Wallr.) Theiss. & Syd.

On old stems of *Clematis ligusticifolia* Nutt. (13679 p.p.).

Family: LOPHIOSTOMATACEAE

LOPHIOSTOMA QUADRINUCLEATUM Karst.

On old branches of *Ribes inebrians* Lindl. (14734) and on old stems of *Artemisia frigida* Willd. (14745).

PLATYSTOMUM COMPRESSUM (Pers.) Trev.

On old branches of *Ribes inebrians* Lindl. (14734 p.p.) and on old branches of *Salix cordata Watsoni* Bebb (14740). Also abundant on old branches of *Crataegus erythropoda* Ashe (14781).

LOPHIDIOPSIS NUCULOIDES (Rehm) Berl.

On old branches of *Symphoricarpos oreophilus* Gray (14754 p.p.). Only a few scattered perithecia found.

Family: HYSTERIACEAE

Hysterium Standleyanum sp. nov.

Perithecia scattered, rarely 2–3-seriate, erumpent-superficial, narrowly elliptic, lips closely connivent except in the middle somewhat open, black, .5–2 mm. long; asci clavate-cylindric, rounded at the apex, short-stipitate, 8-spored, $70–75 \times 10\,\mu$; spores overlapping biseriate, oblong-fusoid, straight or curved, subobtuse at the ends, 4–7-septate, unconstricted, the third or fourth superior cell globose, enlarged, each cell nucleolate when young, hyaline at first, becoming yellow or reddish-brown, $20–23 \times 3.33–4.5\,\mu$.

Differs from *Hysterium Notarisianum* Rehm in narrower and longer spores, in the location of the enlarged cell, and in the absence of any occasional longitudinal septum in any of the cells.

On old scrub oak branches (*Quercus Fendleri* Liebm. ?) (14693).

HYSTEROGRAPHIUM BAKERI Earle

On old branches of *Cercocarpus montanus* Raf. (14789 p.p.).

LOPHODERMIUM ARUNDINACEUM (Schrad.) Chev.

On *Koeleria cristata* (L.) Pers. (13591), on *Calamagrostis hyperborea americana* Vasey (13624) and on old leaves of *Danthonia intermedia* Vasey (14312 a, p.p.). The form on *Danthonia* is probably the var. *alpinum* of Rehm.

Order: PEZIZALES

LACHNELLA FLAMMEA (A. & S.) Fr.

Lachnella rhoina Earle Pl. Baker **2**: 5, 1901.

On old branches of *Schmaltzia Bakeri* Greene (14720, 14756 p.p.).

FABRAEA LITIGIOSA (R. & D.) Sacc. ?

On leaves of *Cyrtorhynca ranunculina* Nutt. (13982), not mature.

PSEUDOPEZIZA MEDICAGINIS (Lib.) Sacc.

On *Medicago sativa* L. (14444).

RHYTISMA SALICINUM (Pers.) Fr.

On leaves of *Salix Bebbiana* Sarg. (14661).

Patellea oreophila sp. nov.

Apothecia sessile, scattered over the surface of the bare wood, at first immersed in or embraced by the fibers of the wood, becoming erumpent-superficial, lecideiform, thinly margined, black, .5–1 mm. in diam.; asci clavate-cylindric, rounded at apex, short-stipitate, 8-spored, $60–80 \times 10–12\,\mu$, iodine reaction negative; paraphyses numerous, filiform, not over $1–1.5\,\mu$ broad, simple, rarely branching, wavy-flexuose, not apically enlarged; spores biseriate, fusoid, at times crescentic or falcate-sigmoid, subacute at the ends, uniseptate, the septum not always medial, not constricted, hyaline to pale-greenish, $27–30 \times 4–7\,\mu$; excipulum brown.

On old decorticated branchlets of *Symphoricarpos oreophilus* Gray (14661 p.p.). No traces of lichen gonidia found.

SCHIZOXYLON INSIGNE (De Not.) Bres.

On old branches of *Crataegus erythropoda* Ashe (14781 p.p.) Only a few scattered ascomata found.

DEUTEROMYCETES

Order: SPHAEROPSIDALES

Family: PHYLLOSTICTACEAE

HYALOSPORAE

PHYLLOSTICTA CRATAEGI (Cooke) Sacc.

On *Crataegus erythropoda* Ashe (14563).

PHOMA ASCLEPIADEA E. & E.

On old stems of *Asclepias speciosa* Torr. (14730).

PHOMA ASTRAGALI Cooke & Hark.

On old stems of *Astragalus oreophilus* Rydb. (14663).

PHOMA COMPLANATA (Tode)

On old stems of *Heracleum lanatum* Michx. (14640).

PHOMA CORNI-SUECIAE (Fr.)

On dead branches of *Cornus instolonea* A. Nels. (14780 p.p.). Det. Dearness.

Phoma Estrelti sp. nov.

Pycnidia numerous, immersed, then erumpent, globose or globose-depressed, centrally ostiolate, black, about 300 μ in diam.; spores numerous, oblong-elliptic, hyaline, 6–8 $\times$ 3–4 μ, basidia not observed.

On *Isocoma heterophylla* (Gray) Greene, Bueyeros, Sept., 1916, Father A. Estrelt.

PHOMA EXIGUA Desm.

On *Polygonum sawatchense* Small (14113), on old stems of *Comandra pallida* A.DC. (14769) and on old stems of *Eurotia lanata* (Pursh) Moq. (14791 p.p.).

PHOMA HERBARUM West.

On old stems of *Gaertneria acanthicarpa* (Hook.) Kuntze (14767), on old stems of *Aster Novae-Angliae* L. (14654), on old stems of *Agrimonia striata* Michx. (14731), on old stems of *Senecio spartioides* T. & G. (14738), on same host (14758), on dead stems of *Pedicularis fluviatilis* Heller (14486), and on stems of *Thermopsis Pinetorum* Greene (14744).

PHOMA HERBARUM MEDICAGINIS Rabh.

On dead stems of *Medicago sativa* L. (14759).

PHOMA HERBARUM SOLIDAGINIS Sacc.

On old stems of *Solidago Pitcheri* Nutt. (14743).

PHOMA OLERACEA Sacc.

On old stems of *Heliopsis scabra* Dunal (14648).

PHOMA RUDBECKIAE Fairman

On old stems of *Rudbeckia laciniata* L. Immature.

Phoma Sidalceae sp. nov.

Pycnidia scattered on whitened areas or gregarious on oblong black spots, globose or oblong, immersed then erumpent, black, $175–200 \times 140\,\mu$; spores numerous, oblong or elliptic, rounded at the ends, simple, 2–3-nucleolate, hyaline, $4–7 \times 3–4\,\mu$, with inconspicuous basidia.

On old stems of *Sidalcea neomexicana* Gray (14251).

PHOMA THALICTRINA Sacc. & Malbr.

On old stems of *Thalictrum Fendleri* Engelm. (14652) and on *Thalictrum dasycarpum* F. & L. (14658).

MACROPHOMA CORNINA (Peck) Sacc.

On dead branches of *Cornus instolonea* A. Nels. (14780 p.p.).

Dothiorella phomopsis sp. nov.

Pycnidia immersed in a basal stroma and aggregated in groups of 1–5, often at the bottom of *Stictis*-like depressions, or occurring singly and without evident stroma, when occurring singly arranged in a subseriate manner between the longitudinal ribs of the stem and becoming erumpent-superficial, globose-depressed, of loose cellular structure, centrally ostiolate, contents white upon section, externally brown or black, $150–300\,\mu$ in diam.; spores borne on stout basidia, numerous, oblong-ellipsoid, rounded at the ends, hyaline, eguttulate, $4–8 \times 3–4\,\mu$.

On old stems of *Viorna Scottii* (Porter) Rydb. (14627).

This is an ancipital fungus, alternating between *Phoma* and *Dothiorella*.

Placosphaeria decipiens Dearness & Fairman sp. nov.

Stromata brown or dull black, subcircular, 1–3 mm. in diam., more frequently linear or effuse, on areas which are red at first; pycnidia black, sub-carbonaceous, hemispheric, 90–200 μ, one or mostly several in a linear series arising more than half their height above the basal stroma, normally 4-sulcate at top; conidia cylindric with rounded ends, hyaline, nucleate, $12–35 \times 4–6\ \mu$, the longer ones sometimes seeming uniseptate.

On leaves, flower-bracts and stems of living *Aster vallicola* Greene, Ute Park, Colfax Co., Sept., 1916, Paul C. Standley, No. 14253.

The affected branchlets become completely darkened with the stromata,—very closely simulating *Dothidea* (*Ophiodothis* or *Phyllachora*) *Haydeni* B. & C. but lacking the shining luster of the latter as well as its depressed and serpentine perithecia. Specimens were sent to Dr. Geo. F. Atkinson who has (Jour. of Mycol. **11**: 257) recorded the results of his examination of the specimens of *Dothidea Haydeni* from the Kew Herbarium. Atkinson says, in. litt., "The spores are larger than those of the type of *O. Haydeni* and also larger than those of F. Col. No. 1332. They are also different in shape according to my observations, that is, they are not attenuate at the ends." The feature of the longer spores being 2-celled or at least with the plasma divided was not observed in F. Col. No. 1332, nor in the type of *D. Haydeni*. In this respect the fungus on *Aster vallicola* approaches *Placosphaerella*.

PHAEOSPORAE

Coniothyrium sepium sp. nov.

Pycnidia scattered or gregarious, immersed then pustuliform-erumpent, subglobose or lenticular, thin-walled, fragile, apparently astomous, black (brown under the microscope) about 100–250 μ in diam.; basidia not seen; spores very numerous, rounded or ellipsoid, ends usually rounded, at times subacuminate or pseudo-apiculate at one end, cell walls thick and dark brown, cell contents light brown and minutely punctate, 1 or more guttulate, $6.66–10 \times 6.66\ \mu$.

On old stems of *Convolvulus sepium* L. (14578).

Under examination with a B. & L. one-twelfth imm. lens the punctate appearance is seen to be due to minute granules in the substance of the spores.

Coniothyrium olivaceum Salsolae var. nov.

Pycnidia scattered or gregarious, seated on the inner bark, becoming erumpent-superficial, globose, with a central pore from 6–8 μ broad, black, 120–200 μ in diam.; spores rounded or ellipsoid, subhyaline, becoming smoky, 4–8 $\times$ 4–5 μ.

On old stems of *Salsola Pestifer* A. Nels. (14765 and 14221).

Coniothyrium olivaceum Thermopsidis var. nov.

Pycnidia numerous, scattered, immersed, then erumpent and raising the epidermis in minute pustuliform elevations, globose or globose-depressed, 130–200 μ in diam.; spores numerous, rounded or ellipsoid, continuous, at first hyaline, becoming smoky-brown, darker in mass, 5–6 $\times$ 3.33 μ.

On old stems of *Thermopsis pinetorum* Greene (14744 p.p.).

CONIOTHYRIUM CONCENTRICUM YUCCAE-GLAUCAE Sacc.

On old stems of *Yucca glauca* Nutt. (14243 p.p.). Cfr. Brenckle, Fungi Dak. No. 428.

CONIOTHYRIUM MYRIOCARPUM (Fr.) Sacc.

On a log of *Populus angustifolia* James (13562 a) associated with *Rosellinia pulveracea* of which, sec. Fuckel, it is the pycnidial stage.

HYALODIDYMAE

Ascochyta Boutelouae sp. nov.

Pycnidia black, scattered and immersed in the substance of the leaves, becoming erumpent, depressed-globose, of thin membranaceous texture, round and about 55 μ in diam., or oblong 90–150 μ in length, with a central ostiolum about 10 μ broad; spores numerous, oblong-cylindric, obtusely rounded at the ends, 4–5-nucleolate at first, then uniseptate, slightly constricted, hyaline or greenish-hyaline, 17–20 $\times$ 6–7 μ.

On *Bouteloua gracilis* (H.B.K.) Lag. Distinct from *Ascochyta*

graminicola Sacc. in broader spores which are not attenuated at the ends. Standley (14256).

PHAEODIDYMAE

MICRODIPLODIA VICIAE Peck

On *Vicia americana* Muhl. (14176).

Microdiplodia galiicola sp. nov.

Pycnidia scattered or gregarious, globose or globose-depressed, immersed in the inner bark, pustuliform-erumpent, or left exposed by the falling away of the epidermal layers of the cortex, dark-brown, 150–250 μ in diam.; basidia not seen; spores numerous, oblong or elliptic, rounded at the ends, uniseptate, slightly constricted at the septum, brown, 7–10 $\times$ 3–4 μ.

On old stems of *Galium boreale* L. (14757).

Microdiplodia Anograe sp. nov.

Pycnidia scattered, globose, minute or punctiform, black, 130–150 μ in diam.; spores numerous, variable in form, oblong and rounded at the ends or oblong-fusoid and subacute at the ends, uniseptate, not markedly constricted, brown, 6–9 $\times$ 3.5 μ; basidia inconspicuous.

On old stems of *Anogra coronopifolia* (T. & G.) Britton (14768 p.p.). Associated with a *Mycosphaerella* which is close to *Mycosphaerella Oenotherae* (E. & E.) but in insufficient amount for determination.

Ascochytula agropyrina sp. nov.

Pycnidia scattered or gregarious, erumpent, globose, black, 250–320 μ in diam.; spores oblong-cylindric, rounded at the ends, uniseptate, constricted at the septum, external cell walls often depressed-concave near the middle, at first hyaline, becoming yellow or greenish-yellow and finally pale-brown, nucleolate, 17–23 $\times$ 6 μ.

On old leaves of *Agropyron Bakeri* A. Nels. (14330 a, p.p.). Cfr. Diedicke on the genus *Ascochytula,* Ann. Mycol. **10**: 141.

HYALOPHRAGMIAE

KELLERMANNIA SISYRINCHII E. & E.

On *Sisyrinchium demissum* Greene (14092).

KELLERMANNIA YUCCAEGENA E. & E.

On old leaves of *Yucca glauca* Nutt. (14243).

STAGONOSPORA CHENOPODII Pk.

On *Chenopodium album* L. (14214).

STAGONOSPORA GRAMINELLA *Sacc.*

On *Sporobolus auriculatus* Vasey (13617).

Stagonospora Humuli-americani sp. nov.

Pycnidia scattered or gregarious, immersed, becoming erumpent-superficial, depressed-globose, centrally ostiolate, brown or black, about one third of a millimeter in diam.; spores oblong-cylindric, rounded at the end, 1–3-septate, not constricted, mostly straight, hyaline, subhyaline in mass, $17–30 \times 3–4\,\mu$.

On stems of *Humulus americanus* Nutt. (14564 p.p.).

PHAEOPHRAGMIAE

Hendersonia Stanleyellae sp. nov.

Pycnidia scattered or gregarious, subepidermal, depressed-globose, black, $150–175\,\mu$ in diam.; spores ellipsoid, or fusoid-oblong, ends attenuated and subacute, 3-septate, not constricted, olivaceous or brown, $13–20 \times 6–7\,\mu$.

On old stems of *Stanleyella Wrightii* (Gray) Rydb. (13516).

Hendersonia Eriogoni sp. nov.

Pycnidia scattered, immersed, then erumpent-superficial, conoid or globose, with minute, protruding, papilliform ostiola, black, $200–300\,\mu$ in diam.; spores numerous, oblong, rounded at the ends, triseptate, not constricted, with a large gutta in each cell, light-brown at first, becoming dark-brown or sub-opaque, $13–17 \times 6.5\,\mu$.

On old stems of *Eriogonum alatum* Torr. (14787).

Hendersonia Petalostemonis sp. nov.

Pycnidia immersed, then erumpent, scattered, globose or globose-depressed, with a flattened base and minute, cylindric, slightly projecting ostiola, black, 250 μ in diam.; spores abundant, oblong-ellipsoid, rounded at the ends, somewhat variable in form, one end often larger, 3-septate, slightly constricted, brown, 10–13 $\times$ 7–8 μ.

On old stems of *Petalostemom oligophyllus* (Torr.) Rydb. (14719 p.p.).

Hendersonia subcultriformis sp. nov.

Pycnidia sparse, globose, at times with mycelial hairs surrounding the basal portion, centrally ostiolate or papillate, black, 250–300 μ in diam.; basidia short or inconspicuous; spores abundant, fusoid or subfalcate, rounded at one end, the other end subacuminate, sharply bent, coulter-shaped or subrostrate, 5–7-septate, each cell uniguttulate, hyaline becoming brown with age, 27–33 $\times$ 6–7 μ.

On old leaves of *Agropyron Bakeri* E. Nels. (14330 p.p.).

Differs from *Hendersonia crastophila* Sacc. in its rostrate, multiguttulate spores, and from *Hendersonia Agropyri* Rostr. in differently shaped spores with more numerous septa.

HENDERSONIA FOLIORUM Fckl.

On old leaves of *Primula angustifolia* Torr. (14349 a).

Cryptostictis utensis sp. nov.

Pycnidia immersed, then erumpent, scattered, globose or oblong-elliptic, black, 250–500 μ in diam.; spores oblong-fusoid, 14–17 $\times$ 3–4 μ, 3-septate, 4-locular, the two middle cells larger, subglobose and brown, the end cells hyaline, acuminate and armed with a hyaline, straight or curved cilium from 10–20 μ in length; basidia long, club-shaped, and hyaline, enlarged at the apices.

On old stems of *Anogra coronopifolia* (T. & G.) Britton (14766). Name for Ute Park, the place of collection.

PHAEODICTYAE

CAMAROSPORIUM AMORPHAE Sacc.

On old stems of *Amorpha canescens* Pursh (14615).

CAMAROSPORIUM COMPOSITARUM (C. & H.) Sacc.

On old stems of *Artemisia frigida* Willd. (14726).

Camarosporium Estrelti sp. nov.

Pycnidia immersed, becoming erumpent and exposed in rifts of the bark, flattened-globose, ostiola central and 40–50 μ broad, surrounded at the base by brown mycelial threads, black, 200–300 μ in diam.; spores oblong-elliptic, often irregular in form, abundant, 2–4-septate, slightly constricted, one or more of the cells with longitudinal septa, brown, 12–18 $\times$ 6–8 μ, borne on moderately long sporophores.

On *Isocoma heterophylla* (Gray) Greene, Bueyeros, Sept., 1916, Father A. Estrelt.

CAMAROSPORIUM PATAGONICUM Speg.

On old stems of *Atriplex canescens* (Pursh) Nutt. (14715).

Camarosporium yuccaesedum sp. nov.

Pycnidia scattered or gregarious, subepidermal, becoming erumpent-superficial, globose or conoid, black, at least 200 μ in diam.; spores numerous, variable in shape, globose, oblong-ellipitic or flask-shaped, usually rounded at the ends, occasionally truncate at one end, 3–5-septate, very slightly constricted at the septa, one or more of the cells with a longitudinal septum, light-brown to dark-brown, 20–30 $\times$ 10–17 μ, borne on stout, cylindric, hyaline basidia.

On dead leaves of *Yucca baccata* Torr. (13517).

SCOLECOSPORAE

SEPTORIA GAURINA E. & K.

On *Gaura induta* Woot. & Standl. (14519), on *Gaura parviflora*, Dougl. not numbered.

SEPTORIA HELIANTHI E. & K.

On leaves of *Helianthus annuus* L. (14467 a).

SEPTORIA OENOTHERAE West.

On leaves of *Lavauxia flava* A. Nels. (14439) and *Oenothera Hookeri* T. & G. (14580).

SEPTORIA SMILACINA E. & M.

On leaves of *Vagnera stellata* (L.) Greene (14264).

Rhabdospora gauracea sp. nov.

Pycnidia caulicolous, gregarious, immersed, then erumpent, depressed-globose, opening by a round or oblong pore, brown or black, 75–100 μ in diam.; spores filiform, straight or curved, nucleolate, hyaline, 30–40 $\times$ 2.5–3 μ.

On old stems of *Gaura induta* Woot. & Standl. (14766). This may be the stem form of *Septoria gaurina* E. & K. Potebnia states (Ann. Mycol. **8**: 65 et seq.) "es ist zweifellos das einige Rhabdospora-Arten mit den entsprechenden Septoria-Arten identisch sind."

PHLOEOSPORA OXYTROPIDIS Ell. & Gall.

On *Oxytropis Lambertii* Pursh (13802).

Order: MELANCONIALES

Family: MELANCONIACEAE

GLOEOSPORIUM POTENTILLAE (Desm.) Ouds.

On *Argentina anserina* (L.) Rydb. (13562) and *Argentina argentea* Rydb. (14076). The teratology of this fungus is considered by Dr. Ernst Voges (Zeit. f. Pflanzenkr. **21**: 269. 1911).

Order: MONILIALES

Family: DEMATIACEAE

CLADOSPORIUM HERBARUM (Pers.) Lk.

On stems of *Lygodesmia juncea* (Pursh) Don. (14725), on *Agropyron Smithii* Rydb. (14301), on old stems of *Cheirinia* sp. (14187), on *Lactuca pulchella* (Pursh) DC. (14516), on *Sitanion*

longifolium J. G. Sm. (13577), on *Stanleyella Wrightii* (Gray) Rydb. (13516.

No. 14737, on *Machaeranthera Bigelowii* (Gray) Greene is the form of this species called (sec. Ferraris, Fl. Ital. Crypt. Fasc. 8: 331) *Dematium pullulans*. No. 13748 on *Koeleria cristata* (L.) Pers. is, probably, *var. cerealium* of Saccardo.

CLADOSPORIUM FASCICULATUM Corda

On old stems of *Juncus balticus* Willd. (14544).

POLYTHRINICUM TRIFOLII Kunze

On *Trifolium Fendleri* Greene (13331 and 14728).

FUSICLADIUM CERASI (Rabh.) Sacc.

On fruit of *Prunus americana* Marsh (14729).

MACROSPORIUM COMMUNE Rabh.

On dead stems of *Castilleja integra* Gray (14616).

CERCOSPORA MONTANA (Speg.) Sacc.

On *Epilobium adenocladon* (Hausskn.) Rydb. (14107).

Family: TUBERCULARIACEAE

TUBERCULARIA VULGARIS Tode

On dead branches of *Padus melanocarpa* (A. Nels.) Shafer (14777), and on branches of *Salix cordata Watsoni* Bebb (14775).

TRIMMATOSTROMA SALICIS Corda.

On branches of *Salix cordata Watsoni* Bebb (14773).

Family: STILBACEAE

Arthrobotryum (?) pestalozzioides Dearness & Fairman sp. nov.

Synnema monocephalous, seated in the cortex and rising through rifts of the thick epiderm, causing it to feel spiny as the

finger is passed over it, very variable in size but averaging in well developed examples nearly .8 × .25 mm.; capitula black, shining, globose, averaging when dry 270 μ in height and 300 μ in width, swelling when moist to a globe 630 μ in diam.; stem reddish-black, averaging 540 μ in length and 230 μ in thickness; conidia *Pestalozzia*-like, 3-septate, 20–26 × 7–11 μ, 14–18 μ between the outer septa, curved on one side, the two middle cells brown, often nucleate, upper one larger; end cells hyaline, lower rostrate, upper terminating in 3 filiform cilia, 25–50 × 2 μ; on fasciculate acute conidiophores.

On dead stems of *Clematis ligusticifolia* Nutt. (13679).

This interesting form stands on unnamed ground between *Stilbum* and *Pestalozzia*. Its association on the same stems with *Ceriospora montaniensis* E. & E. and the similarity of the spores make it extremely probable that this is the conidial form of the last named species.

LYNDONVILLE,
NEW YORK.

NOTES AND BRIEF ARTICLES

Dr. Elias J. Durand, of the University of Missouri, has been appointed professor of botany in the University of Minnesota.

Dr. Helen M. Gilkey, of the University of California, has been appointed assistant professor of botany and curator of the herbarium in the Oregon Agricultural College, to succeed the late H. S. Hammon.

Professor Bethel, of Colorado, has been appointed a pathologist in the Office of Investigations in Forest Pathology.

Dr. L. M. Massey, of Cornell University, is now in extension work on the control of truck crop diseases in New Jersey, with headquarters at New Brunswick.

Mr. G. B. Ramsey, of the Maine Experiment Station, has been appointed extension pathologist in Maine, with headquarters at Orono.

Prof. A. H. Graves has been studying the problem of disease resistance in chestnut trees about New York City, in areas where the canker first appeared, and finds some very interesting things. His results, however, are not yet sufficiently complete for publication.

A double number of the *Journal of the Elisha Mitchell Scientific Society* for June, 1918, is devoted to the Lactarias of North Carolina by W. C. Coker. As usual, the descriptions are accompanied by very handsome plates. Fifty species are recognized for the state, of which the following are described as new: *L. Allardii, L. subtorminosus, L. furcatus, L. coleopteris, L. Curtisii, L. subplinthogalus,* and *L. lentus.*

Gautieria has been recently studied by S. M. Zeller and C. W. Dodge, and the American species treated in a recent issue of the *Annals of the Missouri Botanical Garden*. Five species are recognized, one from Indiana, *G. plumbea,* being described as new.

A canker of poplars and willows caused by *Cytospora chrysosperma* is described by W. H. Long in the *Journal of Agricultural Research* for May 6, 1918. The author states that this canker is serious and prevalent throughout the semi-arid regions of the southwestern United States. Methods of control include the use of resistant species, careful tillage, protection, and strict supervision over nursery stock.

Dr. F. C. Stewart, in Bulletin 448 of the New York Agriclutural Experiment Station, fully describes and beautifully illustrates the appearance and habits of *Collybia velutipes,* an edible fungus remarkable for its ability to withstand cold. Dr. Stewart believes that it should be better known and more generally used for food, and he intimates that it may be possible to cultivate it.

Young plants of red cedar, and certain other species of ornamental conifers, have been subject recently to a disease which has caused great loss in a number of nurseries. This seems to be due to a species of *Phoma,* a microscopic parasitic fungus. Spraying has had little effect on controlling its attacks.

It is stated on good authority that nearly 100,000,000 bushels of wheat and oats are destroyed annually by grain smuts, which could easily be prevented by the simple and inexpensive formaldehyde treatment of seed. The tiny spores of the smut-fungus cling to the grains and germinate with them in the soil. Formaldehyde prevents the germination of the spores but does not affect the seed.

English walnuts are often attacked by *Armillaria* root-rot, which spreads from one tree to another through the soil. It has

been found that if the dirt is dug away until the graft unions are exposed and cylinders of heavy roofing paper placed around the base of the trees and the soil filled in, that the fungus is prevented from entering the walnut trunk.

The species of *Russula* found in the State of North Carolina have been treated by H. C. Beardslee in the *Journal of the Elisha Mitchell Scientific Society* for January, 1918. Many of the notes and photographs are by Dr. W. C. Coker. The style of treatment is the same as that of other papers on fleshy fungi appearing in this journal. Forty-seven species are recognized, among which the following are described as new: *R. cinerascens, R. magna,* and *R. pungens.*

A disease of narcissus which has been attributed to a species of *Fusarium,* a microscopic fungus, is now known to be due to a nematode. The disease appears first in the neck of the bulbs, causing the leaves at and below the soil to decay and fall over. The nematode may pass from the diseased parent bulb to an offset but does not appear to pass from one bulb to another in storage. Rotation, trap-plants, heat, and spraying solutions are mentioned as preventative and remedial measures.

Bulletin 658 of the United States Department of Agriculture, by James R. Weir and E. E. Hubert, gives an outline of forest disease surveys, which are carried out in conjunction with timber survey projects in order to obtain data of economic value in conducting future sales of the areas in question. The results are recorded on pathological maps, indicating the principal infection areas. Several of the common fungous diseases affecting trees are described and illustrated in this bulletin.

Specimens of *Globifomes graveolens* were recently collected by Professor A. H. Graves on a living red oak trunk near New Dorp, Staten Island. This very curious and interesting tree-destroying fungus was first described from Georgia by Schweinitz and is of

rare occurrence on oak, beech, and maple as far north as Pennsylvania and as far west as Iowa. This is the first time it has been found within the local flora range.

A leaf blight of *Kalmia latifolia* is described by Ella Enlows in the *Journal of Agricultural Research* for April 15, 1918. This disease is characterized by blight or dry-rot involving large areas either of the leaf blade or of the entire leaf. It may even extend into the stems and eventually kill the entire plant. The fungus involved is described as a new species, *Phomopsis Kalmiae.* Several illustrations accompany the description.

To develop varieties of wheat that will resist black rust, the United States Department of Agriculture is working in cooperation with the state experiment stations of Minnesota, Kansas, Tennessee and Iowa. Rust-resistant durum wheats and other resistant varieties are being crossed on varieties known chiefly for their milling and bread-making qualities to obtain rust-resistant strains of good milling quality. Extensive milling and baking experiments have been made with a number of these hybrids.

The Office of Fruit Disease Investigations, Bureau of Plant Industry, has recently added the following pathological workers to its staff: for work in cooperation with the Bureau of Markets on the inspection of carload lots of fruits at terminal markets and the identification of diseases affecting such shipments, Dr. B. O. Dodge, formerly an instructor at Columbia University, Mr. H. D. Hendricks, of Anderson, Indiana, and Mr. John G. Hall; for work on the diseases of small fruits, Miss Grace A. Dunn, of Lake Erie College, Ohio, Mr. W. H. Sawyer, Jr., of Lewiston, Maine, and Mr. Arthur N. Wilcox, of Wisconsin University; for work on pecan diseases, Mr. J. B. Demaree, formerly with the State Board of Entomology of Indiana; and for general work on fruit diseases, Professor A. H. Chivers, formerly assistant professor of botany at Dartmouth College, New Hampshire.

An excellent and handsomely illustrated article on *Fomes officinalis,* by J. H. Faull, appeared in the *Transactions of the Royal Canadian Institute, Toronto,* volume XI. The history, distribution and hosts, chemistry, dissemination, and effect on timber are all fully treated. It produces a red heart-rot of conifers characterized by the removal of the cellulose, by the fracturing of the wood into rectangular masses, and the formation of mycelial sheets in the crevices, the effects being not unlike those caused by *Polyporus Schweinitzii.* It occurs on both living and dead timber and belongs to the group commonly regarded as wound parasites. The range of this species in America is reported by the author to be as follows: British Columbia, Ontario, Quebec, Arizona, California, Oregon, Washington, Montana, Nevada, Idaho, Wisconsin, Michigan, and Wyoming.

The Report of the State Botanist of New York for 1916, by Dr. H. D. House, formerly a student at the Garden, contains a number of articles of interest to botanists in general. In addition to the usual list of accessions and local flora notes, there is a long list of species of lower fungi, either new or interesting; a list of the fungi of Chautauqua County contributed by Dr. D. R. Sumstine; and a list of the flowering plants and ferns of the Oneida Lake region by Dr. H. D. House. One of the most interesting parts of this report is an ecological treatment by Dr. House of the vegetation of the eastern end of Oneida Lake, which is illustrated with very handsome photographs. *Coriolopsis rigida* is reported on dead limbs and trunks of poplar and the range of the species is said to extend northward to Essex County, New York, southern Ontario, and Wisconsin.

The Office of Cotton, Truck, and Forage Crop Disease Investigations, Bureau of Plant Industry, has recently appointed Mr. W. S. Porte, of Rutgers College, New Jersey, as scientific assistant in plant pathology, to assist in tomato spraying experiments; Mr. S. L. Dodd, Jr., formerly with the West Virginia State Crop Pest Commission and Agricultural Experiment Station, as extension pathologist in the state of West Virginia, with

headquarters at Morgantown; and Mr. G. M. Armstrong, instructor in plant pathology at Clemson College, South Carolina, as extension pathologist in the state of Alabama, with headquarters at Auburn. Mr. C. S. Ridgway, of the Bureau of Plant Industry, has been transferred from assistant in tobacco disease investigations to the position of extension pathologist in the state of Maryland, and Mr. D. C. Neal from the citrous disease investigations of the Bureau of Plant Industry to the leadership of the pathological extension work in Louisiana, with headquarters at Baton Rouge.

The campaign to eradicate the common barberry, which was started by the United States Department of Agriculture last spring, has already met with gratifying results. The common barberry harbors the black, or stem, rust of wheat, oats, barley, and rye, a disease which causes enormous losses in this country. In certain European countries it has been demonstrated that the eradication of the barberry has resulted in a marked decrease in the amount of damage caused by this disease. In central and northwestern states where the campaign is being conducted, public sentiment has been aroused. Nurserymen for the most part have agreed to discontinue distributing common barberry bushes. Park boards in many cities have eradicated them. State nursery inspectors and state entomologists are destroying the bushes wherever stem rust infection is found. Several state councils of defense have issued appeals for the eradication of this barberry, and the public safety commission of Minnesota has issued an order providing for compulsory eradication in that state. The Japanese barberry does not come under the ban, as it does not harbor the rust.

INDEX TO AMERICAN MYCOLOGICAL LITERATURE

Arthur, J. C. New species of Uredineae—X. Bull. Torrey Club **45**: 141–156. 1 My 1918.

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Gautieria plumbea sp. nov. is described.

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Nine new species are described.

MYCOLOGIA

VOL. X NOVEMBER, 1918 No. 6

DALDINIA VERNICOSA—A PYROXYLOPHILOUS FUNGUS

ARTHUR S. RHOADS

(WITH PLATE 14)

The collector is thoroughly aware that numerous species of fungi occur prevailingly on burnt places. Although some of these forms are found elsewhere occasionally, many are so constantly associated with burnt places that they are sought only in such a habitat. In order to account for this peculiar association many plausible but inadequate reasons have been advanced. The fact remains, as stated by Seaver (1), that sterilization of the substratum by heat apparently brings about some change in the soil other than the simple elimination of competition in the destruction of bacteria and other fungi, which changes appear to be of vital importance in the cultivation of fungi which normally grow on a burnt substratum. Later experiments by Seaver and Clark (2), dealing with the artificial cultivation of a species of *Pyronema,* show that soil heated in various ways, especially by burning over the surface, becomes a very favorable nutrient medium for fungi of various kinds by reason of the large amount of food material rendered available through the heating of the materials in the soil. It is only natural to suppose that wood or bark, when burnt, likewise becomes a more favorable medium for the growth of certain fungi.

The writer has made several collections of *Daldinia vernicosa* (Schw.) Ces. & De Not. in various states throughout the East and generally finds it to be associated with fire-scorched trees. So far

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as can be determined this fungus is confined entirely to dicotyledonous trees but occurs upon a great number of species, preferably upon fire-scorched trunks. It attacks small saplings even more readily than larger trees and seems to prefer species of hickory for a host.

While making a survey of a burned area in the latter part of August, 1916, with a view to securing data in regard to the rapidity of the deterioration of standing fire-killed timber by one of our most common sap-rotting fungi, the writer was impressed by the abundance of *Daldinia vernicosa* on the dead trees. An area was selected near State College, Pa., that had been burned for the first time, a surface fire having swept through it 1 year and 3 months previously. As a result the trees on this area, with few exceptions, were scorched so badly that they were killed outright. From this burned area an average sample tract, 100 by 500 feet, was laid off and the following data were secured for each standing tree within this tract: species, diameter (measured to the nearest inch) at breast height, conditions (as to whether dead or living), and the species of fungi growing upon it as evidenced by the sporophores upon the trunk. The species of trees upon this tract in the order of their importance were white oak, scarlet oak, white pine, mocker nut hickory, red maple, chestnut, and pitch pine. The data obtained are given below, the trees being tabulated by diameter under each species:

Out of 71 scarlet oak trees upon this tract only 1 bore sporophores of *Daldinia vernicosa.* There also were present 15 red maples, 6 chestnuts, 37 white pines, and 1 pitch pine but no trees of these species bore sporophores. Out of a total of 363 dicotyledonous trees occurring upon this tract 46, or 13 per cent., bore sporophores of *Daldinia vernicosa* within 1 year and 3 months after the trees were scorched by fire. All the trees tabulated above, save one, were dead at the time of the reconnaissance.

The above figures clearly indicate how extensively and rapidly this ascomycete can propagate itself when afforded a favorable substratum. The accompanying photograph (Plate 14, *A*), taken in the latter part of August with a previous record of two months of dry weather, testifies to the luxuriant growth made by the

SUMMARY OF TREES BEARING SPOROPHORES OF DALDINIA VERNICOSA BY SPECIES AND SIZE

Species	D. B. H. inches	No. of trees on area	No. bearing sporophores of *D. vernicosa*	Per cent bearing sporophores of *D. vernicosa*
Quercus alba.	2	12	3	25
" "	3	51	16	31
" "	4	37	5	14
" "	5	40	5	12
" "	6	33	6	18
" "	7	27	1	4
" "	8	19	0	0
" "	9	8	0	0
" "	10	3	0	0
" "	11	6	0	0
Quercus alba, total trees		236	36	15
Hicoria alba.	1	7	2	29
" "	2	12	4	33
" "	3	6	2	33
" "	4	5	0	0
" "	5	3	0	0
" "	6	1	0	0
" "	7	1	1	100
Hicoria alba, total trees		35	9	26

sporophores of this fungus. Sporophores gathered and taken into the laboratory at this time shed copious quantities of spores.

Associated with *Daldinia vernicosa* was another pyrenomycete, *Nummularia Bulliardi* Tul. The stroma of this fungus is effused, thin, and crustaceous. It overspreads the surface of the inner bark, throwing off the epidermis for 6 inches or more in extent and is black and carbonaceous at maturity. This fungus, however, was found only on the white oak and scarlet oak trees. It is quite common throughout this region but always associated with dead oak trees. It is not, however, so restricted to fire-killed trees as is its associate, *Daldinia vernicosa,* but is apparently always associated with dead trees, preferably oak trees.

The genus *Daldinia* is characterized by the peculiar structure of the stroma, which is superficial, subglobose, and has a black and carbonaceous external layer when mature, in which the perithecia are imbedded. The stroma is softer inside, of a radiate-fibrous structure and concentrically zoned.

There are 24 species of *Daldinia,* mostly from the tropics, given

in Saccardo. For the most part they can be referred to *Daldinia concentrica,* which is a common and widely distributed plant occurring in almost every country in the world. In Australia this species assumes large size, frequently becoming two or three inches in diameter as it sometimes does in the western United States. In Europe, *Daldinia durissima* was proposed by Fries many years ago, but, according to Lloyd (3), no one else ever found it, a type at Kew being only the common *D. concentrica.* Massee found a specimen in tropical America (Trinidad) which he named *Daldinia aspera.* Lloyd, however, states that this specimen is not a *Daldinia* (3) at all but a Hypoxylon, probably *H. cerebrinum* (4). Léveillé discovered two species in the United States, *D. cingulata* and *D. loculata,* but Lloyd (3) states that both are the common *D. concentrica.* Two well-known and apparently distinct species of *Daldinia* occur within the United States, namely *D. concentrica* (Bolt.) Ces. & De Not. and *D. vernicosa* (Schw.) Ces. & De Not.

Peck (5), in his list of the plants of North Elba, reports *Daldinia vernicosa* on dead trunks of young, standing deciduous trees. He states that it is very doubtful if this and *D. concentrica* are really distinct species, and is of the opinion that connecting forms occur. It would appear that Peck had not collected *Daldinia vernicosa* as typified by the specimens in the Schweinitzian herbarium, for, if he had done so, it is difficult to see how such specimens could be considered identical with *D. concentrica.*

The stroma of *Daldinia concentrica* is subglobose or hemispheric, or rarely obovoid, while that of *D. vernicosa* is subturbinate and sometimes contracted behind into a thick stipe-like base which is often concentrically wrinkled. The stromata of both species become black when mature, but that of *D. vernicosa* becomes distinctly shining. When young and immature the stroma of *D. vernicosa* contains a large quantity of a colorless gelatinous substance which dries down at maturity, forming the radiate-fibrous substance between the concentric zones. At maturity practically all of the substance between the thin, blackish, concentric zones under the terminal, monostichous perithecial layer is made up of a colorless, radiate-fibrous, dry-gelatinous

substance. It is thus seen that the interior of the stroma of this plant is of a very heterogeneous texture. As a result of the loose texture of the radiate-fibrous inner substance the mature fruit-bodies can be crushed readily between the fingers. In *Daldinia concentrica* the interior of the stroma also is of a radiate-fibrous structure. Owing to its more homogeneous structure, however, it is fairly firm and solid, and specimens that have not been attacked by insects are very resistant to crushing. In the latter plant the radiate-fibrous substance is brown instead of colorless, as it is in

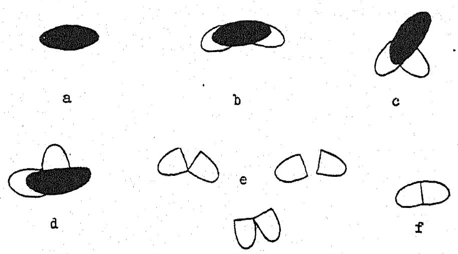

FIG. 1. Spores of *Daldinia vernicosa* showing various stages in the dehiscence of the exospore wall after treatment with dilute KOH; *a*, spore at time of shedding; *b*, spore showing the initial step in the dehiscence of the exospore wall; *c* and *d*, spores showing the casting off of the exospore membrane; *e*, cast-off exospore membranes, some with the valves still hinged together; *f*, a later stage of *e*, showing the return of the two valves to their original position. × 500.

D. vernicosa (Plate 14, *B*), and the concentric zones are not so sharply defined as those of the latter species. As pointed out by Ellis and Everhart (6) the perithecia of *D. concentrica* are monostichous and not polystichous as stated by Saccardo. But little difference is exhibited by either the perithecia, asci, or spores of the respective species. The spores of *D. concentrica* are obliquely uniseriate with the ascus, inequilaterally elliptical, dark-brown, and finally opaque. They are somewhat variable in size but usually conform to 12.5–18 μ by 7–10 μ. The spores of *D. vernicosa* are about the same size as in the preceding species but are somewhat smaller and less variable in size. They usually conform to the limits of 10–14.5 μ by 7–7.5 μ.

The spores of *Daldinia vernicosa* are peculiar in that, when mounted in dilute (5 per cent.) KOH or NaOH, the exospore wall, which is colorless, quickly dehisces and separates from the spore, which is dark-brown. A single peripheral line of dehiscence occurs at the center of the spore and the two halves of the exospore wall usually break away from one another as two valves, or they may dehisce partially and bend backward as if they were hinged, thus allowing the spore to free itself from its peripheral membrane (Fig. 1). The spores of *Daldinia concentrica* also exhibit the same behavior, and, with equal facility. These observations on the dehiscence and shedding of the colorless exospore wall of these two species, when the spores have been mounted in dilute solutions of KOH and NaOH as well as certain other dilute alkaline solutions, have been confirmed by the careful and repeated examination of specimens from widely distant points in several localities. This dehiscence of the exospore wall is less evident, however, in old herbarium material.

Ellis and Everhart (6) sum up the differences between *Daldinia vernicosa* and *D. concentrica* as follows: "This (*D. vernicosa*) is distinguished from *D. concentrica* by its shining-black stroma, and the looser texture of the radiate-fibrous inner substance which is cut by 8–12 dark-colored, membranaceous horizontal plates or layers. These are very noticeable in a vertical section even in the young plant, while it is still covered with the conidial layer and before the terminal, subglobose, ascigerous stroma has begun to appear. In the mature state, the fibrous inner substance and the horizontal membranes disappear to a greater or less extent, and leave the stroma more or less hollow, so that it may be easily crushed with the fingers, but in *D. concentrica* the inner substance remains firm and is also of a darker color."

Daldinia concentrica, according to Lindau (7), is of cosmopolitan occurrence on dicotyledonous wood, while *D. vernicosa*, according to Saccardo (8), is less widespread in its distribution. In addition, the latter species generally occurs on burned woody stems, whereas the former species does not seem to be pyroxylophilous.

It is often very difficult to secure mature specimens of *D. con-*

centrica, and sometimes exceedingly difficult to secure mature specimens of *D. vernicosa* that are free from insects. Even after excellent specimens are collected, the interior portions of the stroma usually are eaten out by the larvae that hatch out within the specimens, unless they are quickly oven-dried.

In addition to his own collections the writer has examined specimens of both plants in the herbaria of Dr. L. O. Overholts, The Pennsylvania State College, The New York State College of Forestry, Office of Pathological Collections in the U. S. Bureau of Plant Industry, the Schweinitzian herbarium in the Academy of Natural Sciences at Philadelphia, and the collections of the Office of Investigations in Forest Pathology. The Schweinitzian herbarium contains the type specimens of *Daldinia vernicosa,* which were first described as *Sphaeria vernicosa* by Schweinitz from specimens collected at Salem, North Carolina.

SUMMARY

1. *Daldinia vernicosa,* as is typical of certain other fungi, occurs prevailingly on a substratum of burnt wood, and is to be regarded as a pyroxylophilous fungus.

2. In its occurrence, it apparently is confined to dicotyledonous species and attacks fire-killed saplings, particularly those of hickory, with great vigor.

3. Out of a total of 363 dicotyledonous trees occurring upon an average sample tract (100 by 500 feet) of a burned area, 46, or 13 per cent., bore sporophores of *Daldinia vernicosa* within 1 year and 3 months after the trees were scorched by fire.

4. Of the 24 (mostly tropical) species of *Daldinia* given in Saccardo, most of them can be considered as mere growth forms or ecological expressions of *Daldinia concentrica,* a widely distributed plant of cosmopolitan occurrence.

5. Only two species of *Daldinia* occur in the United States, *D. concentrica* and *D. vernicosa,* which appear to be morphologically quite distinct.

6. The dehiscence of the colorless exospore wall occurs along a single central peripheral line and seems to be a characteristic feature of regular occurrence with the spores of both *Daldinia*

vernicosa and *D. concentrica*, when mounted in dilute alkaline solutions.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

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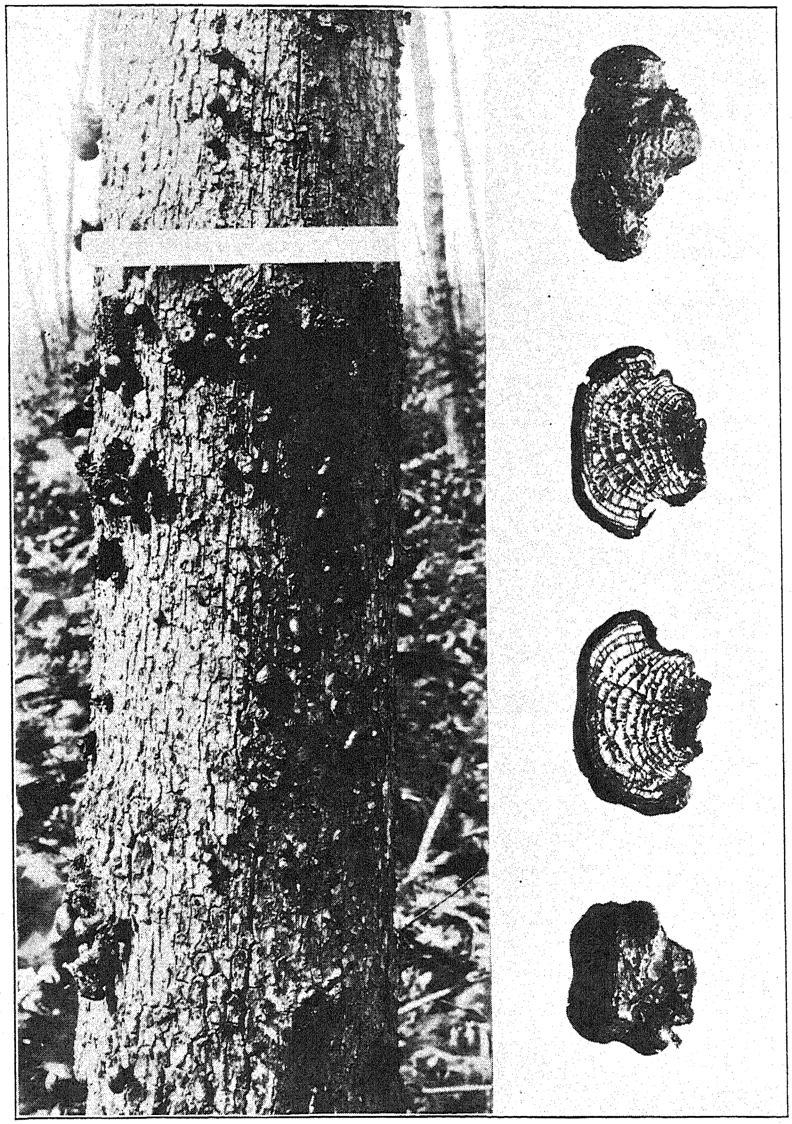
EXPLANATION OF PLATE 14

A. Trunk of white oak (*Quercus alba* L.) one year and three months after it was killed by a light surface fire, showing the abundance of *Dalidinia vernicosa.* The trunk bears a 6-inch rule.

B. Sporophores of *Daldinia vernicosa,* showing both external and sectional views, natural size.



A B

DALDINIA VERNICOSA (SCHW.) CES. AND DE NOT.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—V

Tyôzaburô Tanaka

Physalospora minuta I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report of the Imperial Sericultural Experiment Station), Tôkyô, Japan. 1^5: 314, pl. 16, figs. 1–3, T. 5, xii, Dec. 1916. (Japanese.)

Perithecia sunk in the matrix, with ostiola erumpent, ellipsoid or globoid, 150–200 μ in diam. and nearly 125 μ in height; perithecial wall black, pseudo-parenchymatous; ostiola 45–50 μ long, about 40 μ across; asci clavate-cylindric, thick-walled above, 60–70 $\times$ 13–18 μ, paraphysate, octosporous; paraphyses filiform, abundant, forming thick periphysatic tissue; ascospores subbiseriate, fusoid or ellipsoid, obtuse, minutely granulate, 18–22 $\times$ 8–9 μ.

On living twigs of *Morus alba*.

Type localities: Gifu-ken, Kaidzu-gun, Shiroyama-mura, Mar. 1909, I. Miyake; Fukui-ken, Mar. 1909, K. Hara; Kyôto-fu, Ayabe-chô, Apr. 26, 1915, I. Miyake.

Illustrations: Three lithographic figures showing detailed structure of the fungus.

Mostly appears in presence of *Macrophoma minuta* Berl. the pycnidia of which are surrounded by blackened hyphae commonly known as subiculum, which occur simultaneously with the formation of perithecia of the present species. Symptoms of the two are identical, shown by minute, gregarious, elevated spots covering certain areas of the twigs. As to the evidence of genetic relationship between the two, since no ascogenous form of the former species has been reported, the new name is given as above.

Ascochyta mori I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Imperial Sericultural Experiment Station, Technical Report), 1^5: 345, Pl. 17, figs. 17–18, T. 5, xii, Dec. 1916. (Japanese.)

Pycnidia ellipsoid or conoid, immersed, later erumpent, with single, apical ostiolum, 160 μ across; ostiola papillate, dark-bordered; perithecial wall pseudo-parenchymatous, not very thick, paler inside, increasingly dark outwards; mycelia surrounding perithecial wall dark-colored, mixing with colorless ones which predominate farthest from pycnidia; pycnospores mostly elliptic, frequently cylindric with blunt ends, or ovoid, septate at the middle, not constricted, 9–11 × 3.5–40 μ, walls colorless, protoplasm pale-greenish, usually not conspicuously granulate but rarely one-nucleate in each cell; pedicel colorless and hyaline, short.

On branches of *Morus alba.*

Type localities: Fukui-ken prefecture, Japan, March, 1909, K. Hara; Idu-no-kuni, Shidzuoka-ken, Japan, Apr., 1909, I. Miyake.

Illustrations: Two black and white lithographic figures showing pycnidium and pycnospores.

Ascochyta moricola Berl. differs from this species in having dark-colored fusoid pycnospores pointed at both ends, and constricted at the septum.

Note: As the name *Ascochyta mori* has already been used by R. Maire (Ann. Myc. **11**[4]: 354, Aug. 1913), I propose a new name, *Ascochyta Miyakei* for this species.

STAGNOSPORA MORI I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station), Tôkyô, Japan. **1**[5]: 348, pl. 17, figs. 22, 23. T. 4, xii, Dec. 1916. Japanese.)

Pycnidia sub-epidermal, walls of thick pseudo-parenchymatous tissue, dark-brown, ellipsoid or globoid, erumpent with short papilliform openings, 130–160 × 120–150 μ; ostiola black and darker than the pycnidial wall; pycnospores cylindric, slightly curved, sometimes inequilateral, rounded at both ends, 3-septate, one septum formed earlier, more or less constricted, colorless, hyaline, granulate, germinating from either end or from both at the same time; 21–26 × 6–9 μ; pedicel short, small; paraphyses filiform, straight or slightly curved and twisted, the innermost the longest, shortening toward the opening.

Illustrations: Two black and white lithographic figures showing pycnidium and pycnospores.

On twigs of *Morus alba.*

Type locality: Yamagata-ken (prefecture) Yonezawa-shi, Mar. 1915, I. Miyake.

It is often observed that the fungus causes the host tissues to disintegrate and usually only bast fibers are left unattacked.

ROBILLARDA MORI I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report of the Imperial Sericultural Experiment Station), 1^5: 346, pl. 17, fig. 19. T. 4, xii, Dec. 1916. (Japanese.)

Pycnidia hypo-epidermal, later erumpent with a single ostiolum, black, globoid or ellipsoid, 200 μ across; ostiola papillate, short and small; pycnospores cylindric, 15–18×2.5–$3\ \mu$; more or less thickened at the middle portion, slightly rounded at the base, and rather pointed at the apex, straight or slightly curved, colorless to pale-greenish, septate at the middle, not constricted, with 3–4 bristles at the end; bristles equal in length.

On dead branches of *Morus alba* (rare).

Type locality: Fukui-ken prefecture, Japan, March, 1909, K. Hara.

Differs from *R. Cavarae* Tognin, which has pycnospores with long pedicels measuring 40–50 μ; and from *R. Celtidis* Scalia, characterized by having paraphyses 40–45 μ long.

CYTODIPLOSPORA MORI I. Miyake, sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station), Tôkyô, Japan. 1^5: 347, pl. 17, figs. 20–21. T. 5, xii, Dec. 1916. (Japanese.)

Stromata scattered or gregarious, black, hemispherically elevated above, then disclosed, rupturing the epidermis, ½–⅔ mm. in diam., round or ellipsoid, pseudo-parenchymatous; pycnidia 4–5, sometimes more than 10 in one stroma, globoid or ellipsoid, with short, flat ostiola; pycnidial wall made up of finely and densely fascicled hyphae, colorless inside; pycnospores colorless, hyaline or pale-greenish, guttulate, cylindric with round ends, ellipsoid or ovoid, even, sometimes irregular, straight or curved, uniseptate, septa centric or eccentric, constricted or not constricted, variable in size, 6–15×3–$5\ \mu$.

On living twigs of *Morus alba*.

Type locality: Tôkyô-fu (prefecture) Nakano-chô, May, 1915, I. Miyake.

Illustrations: Two black and white lithographic figures showing pycnidia and pycnospores.

Found nowhere else, parasitic; mycelium intercellular and with haustoria entering the host cells.

DIMEROSPORIUM MORI Y. Endô sp. nov. in Dainippon Sanshi Kwaishô (Journal of the Sericultural Association of Japan), 26^{303}: 300, fig. B on p. 288, Apr. 1, 1917. (Japanese.)

Perithecia large, ellipsoid, 110–120 μ high, 130–140 μ across, without appendages, dark-brown; perithecial wall consisting of large cells containing several oil globules in each cell; asci numerous, clavate, thin-walled, $60–70 \times 12–15\,\mu$, 8-spored; ascospores almost definitely biseriate, oblong, subacute at both ends, $7–8 \times 5–7\,\mu$, yellowish-brown, uniseptate, with 1–2 shining oil globules in each cell.

Epiphytic on leaves of *Morus alba* (mostly on variety *Nezumigaeshi*), occurring with a species of *Meliola*. Catenulate hyphae, unicellular microconidia, multicellular macroconidia, gemmae, spermogonia, and pycnidia were observed, but it was not determined to which species they belong.

Locality: Ueda, Chiisagata-gun, Nagano-ken, Japan, nursery ground of Ueda Sericultural College, and mulberry fields of Tokida section east of the college grounds.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NOTES AND BRIEF ARTICLES

Professor F. S. Earle spent some days at the Garden about the middle of August and then sailed for Porto Rico, where he will investigate for the United States Government a serious and rather obscure disease of sugarcane.

Mr. Stephen C. Bruner, formerly assistant pathologist at the Estación Experimental Agronómica, Santiago de las Vegas, Cuba, has been appointed pathologist to succeed Mr. John R. Johnston, now head of the Office of Sanadad Vegetal, Havana.

Venenarius pantherinoides, described by Murrill from Seattle in 1912, has recently been collected at Olympia, Wash., by Miss M. McKenny, who states that it was eaten by two persons with almost fatal results.

Mr. F. W. Haasis reports in the *Journal of Agricultural Research* for 1917 that young pines in plantations at Portland, Conn., were found to be dying around ant-hills, the trouble being usually associated with fungous and scolytid infestations. Ants are thought to be instrumental in spreading the disease.

In a recent number of *Science,* Professor Gage suggests an excellent method for the preparation of lantern slides showing diagrams, tables, etc. This consists in first covering the glass with a thin coating of varnish and then drawing upon it with a pen, using India ink. Such slides may be covered and bound if desired for permanent use.

An unprecedented danger from fire in the National Forests of the Northwest and Pacific Coast, owing to early drought, high winds, electrical storms, labor shortage, and depletion of the regular protective forces because of the war, has made necessary a

loan of \$1,000,000 to the Forest Service from the President's special defense fund.

A particularly large and excellent collection of fungi, accompanied by beautiful photographs and many notes, has been sent to the Garden for determination by Henry J. Rust, of Coeur d'Alene, Idaho. This region is interesting because it lies near the boundary line between the Rocky Mountain region and the Pacific coast.

Several wood-destroying fungi have been recently sent in for determination by Professor R. J. Blair, of McGill University, Montreal; among them *Coriolus pubescens, Coriolellus serialis, Gloeophyllum trabeum, Lentodium tigrinum, Pyropolyporus conchatus, Phaeolus sistotremoides,* and *Micromphale ulmarium.* Specimens of *Lentodium tigrinum* are particularly well developed, which is rather rare for this species.

A gigantic specimen of *Ganoderma sessile* Murrill, a bracket fungus with a reddish, shining surface, was brought to the Garden early in September by Mr. Michael Dougherty, who found it at the base of a dead red maple in Central Park. The specimen in its dried state measured 18 inches across and consisted of several layers superimposed, making the entire cluster about 6 inches thick. This species has been said by some to be identical with *Fomes lucidus* of Europe, but it is quite certain that no European mycologist would recognize it in this New York form.

A serious disease of wheat, long known in Europe, has recently been found in certain parts of the United States, particularly in Virginia, where in some fields losses have been as high as 40 per cent. of the crop. The disease, caused by a small nematode, or eelworm, usually affects the wheat heads, although it may occur on all parts of the plant above ground. Affected heads stay green and ripen late and are smaller than those not affected. The chaff usually opens at a wide angle. In place of grains of wheat,

the affected heads contain dark, hard galls somewhat shorter and thicker than wheat grains. Control measures consist of planting only disease-free seed, practicing crop rotations, and preventing the spread of the nematodes from one field to another by means of infected soil which may cling to the feet of men or animals or to farm implements.

A recent paper by Stakman and others, in the *Journal of Agricultural Research,* treats of the impossibility of breeding cereals permanently resistant to rust. The facts recorded in the paper, supported by experimental work in the rust nursery and by field observations, indicate that rust resistance is comparable with other permanent characters, and that it is not primarily controlled by seasonal conditions, soil type, geographical location, or other cultural conditions. It is rather an hereditary character, which cannot be produced by the accumulation of fluctuating variations within a susceptible line, nor broken down by changes in the host or parasite. The resistance of wheat varieties may vary in different regions because of the presence of different biological forms of rust.

Mr. Frank N. Meyer, one of the most successful agricultural explorers ever employed by our Government, was missed from a steamer on the Yangste River early in June and his body was afterwards recovered. There were no indications as to the cause of death. Many duplicates of Mr. Meyer's collections of fungi in the Orient came to the Garden for determination and were deposited in the herbarium. Only recently, Mr. Meyer succeeded in discovering the chestnut canker on wild chestnut trees in China, the original home of the disease.

It is stated by Mr. J. B. Rorer that an alga, *Cephaleuros virescens,* causes a leaf-fall and die-back disease of cacao on practically every estate in Trinidad. This disease has been under observation since 1912 and has been described as attacking any cacao tree at any time during the year, but more readily during the last

two months of the dry season, especially if the trees are not in a good situation or condition. The disease has been called die-back and sun-scald, but the author suggests the name of algal disease in order to distinguish it from true die-back and sun-scald, which are said to be caused by a Diplodia. Spraying with Bordeaux mixture has been attended by beneficial results, and attention to tillage, drainage, shade, and protection from wind are also considered essential to the complete control of the disease.

In the *Journal of Agricultural Research* for 1918, W. H. Long and H. M. Harsch describe a method for differentiating various wood-rotting fungi by their cultural characters alone when grown upon artificial media. It is claimed that when cultural characters of closely related but really distinct species are compared, marked and constant differences in the character of the mycelium will be found on certain corresponding agars in the series of cultures representing the two species, while if the fungi are really of the same species, no constant differences will occur. Basing the conclusion on these facts, the authors state that unknown rots can be identified by making pure cultures of the causative organisms from diseased wood.

Professor Bruce Fink, of Miami University, has contributed the following note:

"On the fifth of September, 1918, I was called to examine what a farmer had brought to Oxford, Ohio, and was exhibiting as an unusual mushroom. I found the exhibit to be a cluster of *Clitocybe illudens,* 90 inches in circumference, 15 inches high, and 44 inches from one side over the top to the opposite side. The cluster was compressed-hemispheric in form. There were approximately 300 plants that stood out so that they could be seen readily, and some bystander thought there were as many as 400 in all, counting those that were compressed between the ones that were plainly visible. Seeing this unusual cluster of fungi recalls that in 1896, I found at Fayette, Iowa, a specimen of *Lycoperdon giganteum* which was 85 inches in circumference. The plant was of the usual form for this species, and was, as I recall, between

18 and 24 inches high. Unfortunately, I took only the measurement of the circumference. The plant would sit on top of a bushel-and-a-half basket of the usual form and extend beyond the basket on all sides."

In order to prevent a large percentage of loss in the new crop of potatoes after storing, the Department of Agriculture is making the following suggestions to farmers:

Get rid of every bit of vegetable matter in the storage cellar; sweep and brush until it is clean; then give a thorough dose of fungicide, either gas or spray, the quickest and easiest to apply being formaldehyde gas. For each 1,000 cubic feet of space, use 10 ounces of formaldehyde and 5 of potassium permanganate. Pour the formaldehyde over the permanganate in a deep container, and then leave the cellar immediately, because the gas is given off at once. Should it be found that these chemicals are too expensive, the Department recommends Bordeaux mixture of 5–5–50 strength. It may be applied with hand sprayer, pump, or broom; it is effective when thoroughly used and it does not cost much. It is expecting too much, says the department, to look for potatoes fit for market from a dirty, ill-ventilated cellar. Time, money, and work spent in growing a crop are wasted if the potatoes are stored where dead potatoes are carrying over the organisms that cause rots. Dry-rot attacks newly stored potatoes through bruises and wounds and spreads throughout the stored supply. Many farmers have cellars that now contain piles of sacks of potatoes, all rotten, sacks and all, and constituting a wet, foul mass that helps to decay the timbers and menaces the crop to be stored.

BYRON DAVID HALSTED

Professor Halsted died at his home in New Brunswick, New Jersey, on August 28, 1918, after a protracted illness. He had occupied the Chair of Botany in Rutgers College for nearly thirty years and had previously been professor in the Iowa State University.

Professor Halsted has served as a member of the Advisory Board of "*North American Flora*," published by the New York Botanical Garden, since the commencement of that work in 1905; and, during the several years preceding, while it was in the organization stage, he was an active member of the group of American botanists who made the enterprise possible. He has been president of the Society for the Improvement of Agricultural Science and of the Botanical Society of America; edited the American Agriculturist for a period; and has also been one of the editors of the Torrey Botanical Club.

He was a highly successful and greatly beloved teacher and investigator of renown. His most important publications have been in the fields of agricultural botany and plant diseases, and they include over 300 titles. His loss is a deep personal bereavement to his many friends and professional associates.

INDEX TO AMERICAN MYCOLOGICAL LITERATURE

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Contains chapter on diseases of pears.

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INDEX TO VOLUME X*

New names, and the final members of new combinations, are in **bold face type.**

* It has been considered unnecessary to include here the species listed in the three following articles, since they are already indexed or specially listed.

Arthur: Uredinales of Costa Rica. See p. 150.
Brenckle: North Dakota fungi. See p. 199.
Weir: Altitudinal range of forest fungi. See p. 11.